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TELEPHONIC FINALITY.

The meeting of the National Independent Telephone Association next week in Chicago calls attention once more to the steady and rapid growth of the independent telephone cause in this country. In spite of the activity and vigor of some of the sectional or state telephone associations, the national body necessarily remains that which has or should have the most representative character; and we should not be surprised if some steps were taken at the present meeting to harmonize and consolidate some of the work which has been done by bodies hitherto coming more or less into clash and rivalry. There is no doubt that frequent meetings are found necessary in the earlier stages of any social or industrial movement, and that a great deal of stimulus and benefit is derived from them; but after a time the charm or glamor wears off to some extent; the great fundamental questions are settled; the expense of frequent meetings is felt to be somewhat of a burden; and, usually, the people who are most interested settle down to a régime of at best one or two meetings a year. In the electrical field this has been the case with regard to the street railway and electric lighting companies and their associations, the two national bodies of which each meet only once a year; while relatively few of the state organizations maintain even yearly meetings to which the word "convention" might be fairly applied. It is perhaps early in the independent telephone movement to expect a settling down to such routine periodicity, but it is evident to anyone who has watched the course of events during the last few years that even in the telephone field a great deal of the foundation and constructional work of organization necessitating constant conference has already been accomplished.

As one looks back over the record of a year, it is seen that there is much good work in the past twelve months upon which the independents are to be congratulated. The standpoint of their maintenance and operation has visibly and markedly improved; their line construction is much better; and money is spent more willingly on the apparatus for both the exchange and the subscriber's station. More efficient service is given, the principles of the work are better understood, and it would indeed be difficult to find a higher class of telephonic service than is furnished by some of the independent exchanges. What is perhaps most important of all is that a great many of these exchanges have found that in order to give good service, better rates must be paid to the exchange by the subscriber, and there has been a gradual toning up, therefore, all along the line. Indeed, one of the noticeable features of independent work in the larger exchanges during the past year has been the drift toward the measured rate system. The advocates of this are increasing in number, and while there are still a great many intelligent independent telephone managers who fight for the flat rate method, we believe that in due time most, if not all of them, will be converted to the scientific basis of operation which is beginning to apply so generally throughout the Bell system, and which to-day obtains more and more in the electric lighting field, as well as in the street railway field—for a five-cent fare is, after all, a measured service, and the "transfer" issued might be compared to the free trunking done for the subscriber from one exchange in a city to another exchange in a remote part of it.

There are, of course, many indications that telephony is very far from finality in this country, from whatever point of view it may be

regarded. No one has yet discovered how many telephones can be installed in any given community, nor how frequently the subscriber can be induced to use his telephone and pay for each call. If there is any one direction in which possibly finality might have seemed to be reached, it is that with regard to the evolution of the familiar type of multiple switchboard exchange. We do not know whether this subject will come up for consideration during the next week at Chicago, but we note that at a meeting in London of the English Institution of Electrical Engineers, the only telephone paper lately brought before that body dealt with the multiple switchboard problem, Mr. Aitken, the author of it, advocating a further development of the divided board, which has found its first exemplification in this country, as for example, in St. Louis. Mr. Aitken has gone even further than Mr. Kellogg in this departure, and has virtually proposed, as Mr. Kempster B. Miller has done, that extremely large exchanges shall be adapted each to serve areas, say, five miles in diameter, each exchange including several large multiple switchboards under the one roof and the subscriber's apparatus being provided with means for calling up at will any one of the switchboards in the wholesale exchange to which he is thus connected. This, it will be observed, is the very antithesis of such a system as that in New York, where considerably over a hundred thousand subscribers are now divided up into well-nigh two-score exchange groups and branch offices. While such a method would obviously get rid of a great deal of trunking, the remedy or new plan proposed itself bristles with many dangers and difficulties, and we note that English opinion on the subject is by no means favorable. The clash between these two ideas of centralization and de-centralization in multiple exchange work seems to provide at least one technical battleground of the future in telephonic development; and while public conventions are hardly the bodies in which such issues can be satisfactorily determined, there is no doubt as to the ample room for discussion of this and many other kindred topics at such a gathering as that at Chicago. We trust that the National Independent body will be encouraged by the success of its annual convention and go forward in its work; that it will enlist new and enthusiastic support, and that it will come to be altogether a power for good in the wondeful electrical industry for a large part of which it assumes to speak.

Oscilligrams and Resonance.

An interesting paper by Mr. M. B. Field has recently been read before the Glasgow section of the British Institution of Electrical Engineers. It covered a number of experimental observations, made with the oscillograph, on voltage and current waves over actual transmission circuits, and it elicited an extended discussion. The results emphasize the importance of using the oscillograph to detect the behavior of pressure or current in a circuit at the particular moment when a sudden change of any kind is to be expected. This behavior can, in many instances, be computed; but there is nothing which will record it and enable it to be studied accurately in detail, except the oscillograph.

The general outcome of the investigation was to show that in a high-pressure polyphase system of cables, aggregating about fifty miles, and operated at about 6,500 volts pressure, there was no resonant effect of any practical importance. The frequency in this case was 25 cycles per second. A distinct ripple of the twelfth-frequency harmonic was, however, to be detected in the currents due to the pulsating action of the armature teeth.

A part of the paper was devoted to the subject of free oscillations, produced in a circuit containing inductance and capacity by a sudden disturbance of the circuit, as by switching it on or off. These effects, as is well known, differ from those attending the steady operation of alternating-current circuits, in being rapidly damped out, and in having a natural, or self-imposed, frequency as distinguished from the frequency impressed by the alternator.

Mr. Duddell, in the discussion of the paper, contributed some useful oscillograms and data observed by him under practical conditions. Among other things it was mentioned that the power-factor of high pressure cables varied in general from 1.5 to 3 per cent. That is to say, the ratio of the watts to the volt-amperes delivered to a cable disconnected from its load varied between 0.015 and 0.03. Cases had been observed, however, in which the power-factor of a cable appeared to be over 10 per cent. In view of the relatively large charging current of high-pressure distribution systems, it is evident that even with a power-factor of no more than 2 per cent., the total annual loss of energy in dielectric losses must be considerable.

If the ratio of the cyclic maximum to the effective value of an alternating current or pressure be termed the stress ratio, oscillographs were adduced to show that the stress ratio on a cable might be increased by resonance from 1.41, the pure sinusoidal value, to 2.0. This was in the case of a tooth-cored 5 kilovolt alternator charging cables. When the alternator was running free, at normal speed and voltage, its e.m.f. wave showed distinctly the ripples due to the armature teeth. The stress-ratio was, however, only 1.45, or but little greater than that for a pure sine wave.

When the alternator was connected to the high-pressure cables, the terminal pressure and speed remaining normal, the shape of the e.m.f. wave became so modified by the resonance of the tooth-frequency, that the stress-ratio increased to 1.67. If the speed and frequency of the alternator was increased 8 per cent., an increased resonance was attained due to the action of the seventh harmonic; and the stress-ratio increased to 1.74, with a visibly different shape of wave. Moreover, when the speed and frequency of the alternator fell 26 per cent. below normal, the fifteenth harmonic came into action, and the stress-ratio increased to 1.94. This observation indicates that the electrical stress on a cable may happen to be considerably increased by allowing a single alternator connected with the cable to slow down under excitation. That is to say, it should be de-excited before being allowed to slow down, and, better still, it should be disconnected from the circuit, then de-excited, and then shut down. Otherwise all the e.m.f. harmonics, due to deviations from the simple sine wave form, will experiment with unerring purpose to excite resonance in the cable at some particular frequency during retardation.

The Institute Niagara Meeting.

Elsewhere in this issue we print the details of the programme for the Niagara Falls meeting of the American Institute of Electrical Engineers. It is an excellent menu, and we believe that it will attract a very large attendance of members, even though a great many of them have become rather tired of going to Niagara for conventions, and hardly care to see the Falls in the midst of the devastation wrought by preparatory work for power plants on the Canadian shore. There would, indeed, be greater eagerness among electrical engineers to visit the great Cataract if more of the electrochemical and electrometallurgical establishments using the current generated by it were open to the public. In fact, as there are so many other points of interest in this country where an Institute meeting could be held, outside great cities, we think it might be well to take them in, and subject Niagara to a prolonged "closed season.'

EXPERIMENTS ON SYNCHRONOUS CONVERTERS.

The last number of the Journal of the British Institution of Electrical Engineers contains a paper by D. W. M. Thornton, read at the Newcastle local section, on experiments connected with the operation of a pair of small converters running under laboratory conditions. One converter was driven, inverted, from a storage battery, and supplied either single-phase or multiphase currents to the other converter, which, in its turn, was connected to an adjustable load on its direct-current side. By inserting the coils of an oscillograph in the alternating-current circuit between the two machines, the waves of pressure and current could be recorded and studied under a great variety of conditions.

One of the main results of the investigation was that the efficiency of the combination was a maximum in the neighborhood of the condition of non-inductive operation, or unit power-factor. The power-factor was, of course, susceptible of adjustment within a fairly wide range by varying the field excitation of the two machines. This condition of nearly highest efficiency at highest power-factor is one which might have been expected on theoretical grounds.

Another salient result obtained was the prominence of armature-reaction magnetic alternating fluxes. The magnetic flux in the field magnetic circuit of a synchronous alternator is constant at no load. When the machine runs under load, however, the armature reaction tends to make the magnetic flux pulsate. This is especially the case when there is any electric oscillation or phase-swinging.

By employing an exploring coil on the magnetic circuit, a very appreciable alternating-voltage was observed therein, generated by armature reaction and phase-swinging. The author examined these induced alternating voltages by the aid of the oscillograph. He shows that they may be accompanied by a relatively large eddy-current loss in the mass of the magnetic circuit, and he also points out that the method is capable of general application to dynamos and motors for the detection of irregularities of operation due to any cause. The wave-forms, curves and tabular matter show that a large amount of work has entered into the preparation of the paper; but the results must be interpreted as specially applicable to laboratory conditions rather than as indicating the relations found under industrial conditions.

AS TO RADIO-ACTIVITY.

We abstracted in the Digest lately a paper on radio-activity which has awakened so much interest that it seems to call for some comment. It was a continuation in logical form of the work which is already familiar on the material emanations from radium and its allies. The burden of the investigation is to show that radium must inevitably disappear or be converted into simpler forms of matter after a few thousand years of life. In plain words, radium must have been created within historic times if the estimates of Rutherford and Soddy are correct. The radium in a chunk of pitchblende, therefore, has been spontaneously formed within a measurable period, and the process is inferentially still going on, the rate of formation being much greater of course than the rate of dissipation as radio-active material in order to account for the present existence of the substance. To a less degree, the same statements apply to uranium and thorium and other radio-active substances. All this is highly interesting if true. To follow up the matter a little further, the experiments of Curie on the spontaneous emission of heat from radium have been interpreted as showing on the electron theory, that radium is a tremendous store of spontaneously emitted energy. The most careful estimates yet made show it to be endothermic to a degree inconceivably greater than any substance heretofore known. If the energy thus stored could be instantaneously liberated, radium would become an explosive of such tremendous energy as to dispense wholesale annihilation.

Now the two statements here collocated are singly sufficiently startling, but taken together, the conception of the continuous spontaneous formation in solid rock of a definite chemical substance inconceivably endothermic and steadily undergoing spontaneous decomposition comes as near to being dynamical "tommy-rot" as anything suggested since the demise of the lamented Professor Keeley. For it should be remembered that radium has been shown to have a perfectly definite and characteristic emission spectrum with definite mathematical relations to the spectra of allied elements, and its atomic weight has been determined by ordinary chemical methods as accurate as that of many other rare elements. It can be separated from other substances by ordinary chemical methods, forms salts with haloids and acids in an entirely regular manner, and behaves in general as it ought to behave from its approximate place in the periodic series. All the chemical facts about it give it a systematic place as a regular chemical substance not set apart from other elements by any remarkably unique peculiarities. It is rare, to be sure, but so are many other elements found in small proportions in unusual minerals. Uranium and thorium, its near neighbors, are fairly well known substances, both possessing the same property of radio-activity under certain circumstances, but in a slightly different way and to a much less degree. Polonium, another allied substance, has far greater radio-activity, but in it the emanations allied to cathode rays of projected matter cut relatively a very small figure, while it also now appears to have a definite chemical identity.

Again, with respect to thorium and uranium, it has been pretty clearly shown by chemical research that radio-activity is not a regular and invariable property under all circumstances, but appears under certain reproducible conditions and may disappear and again be reproduced. It seems to belong to them in much the same way as the phenomenon of phosphorescence belongs to calcium sulphide prepared in certain particular ways. Radio-activity may or may not be allied directly to phosphorescence, but it has already been shown to pertain to altogether too many kinds of matter to allow of a highly specialized explanation applicable to radium and its allies and yet not holding for commoner substances. As we have several times taken occasion to remark, the main trouble with investigations of radio-activity is a tendency to rely blindly on electrical evidence for the explanation of these apparently very complicated but widely generalized physical properties. To look at the matter without professional bias, the electrical evidence as to the facts recited at the beginning of this comment, by itself and uncorroborated by independent sources of information, is "not worth the powder to blow it up," if taken alone. The electrical effects of radio-active material are valuable means of investigation, but they tell only a part, and perhaps a rather small part of the whole story. Moreover, many of the conclusions drawn from them rest on the perhaps current, but as yet unproved, assumption that the values of electrical functions are continuous through so profound a change of state as that which may separate matter from non-matter—using the terms in their chemical sense. Until the electrical evidence is backed up by direct evidence not based on this assumption, one should be very cautious in drawing sensational conclusions from it. In the particular instance under consideration, the trend of general chemical and physical evidence is decidedly against the conclusions advanced, and whether they are ultimately proved sound or not, they should at the present stage of affairs be accepted only tentatively and cautiously while awaiting further information.

Degrees for Cooper Hewitt and J. J. Thomson.

Special interest was given to the commencement exercises at Columbia University, New York, last week, by the fact that degrees were conferred on Prof. J. J. Thomson, of England, and on Mr. Peter Cooper Hewitt. The former was presented to President Butler by Prof. W. H. Hallock, who said: "Just a century ago no less a man than Lord Brougham, in the *Edinburgh Review*, held up Young and his classic work to ridicule, and his friend and fellow student, Sir David Brewster, more than a score of years later said that "his chief objection to the undulatory theory of light was that he could not think the Creator guilty of so clumsy a contrivance as the filling of space with ether in order to produce light." Almost simultaneous with the death of Brewster appeared that most beautiful generalization of Maxwell, which at a stroke converted the ether into the all-important factor of the material universe, and from that day the study of this subtle medium has progressed until it is safe to say that we know much more about it than about matter. The most important physical investigations of the day deal with the connection between what, for the lack of a better term, we call matter, and the ether, and no one has contributed so much to the solution of this question as this candidate. The human mind may recoil from the contemplation of limitless space and numberless worlds, but still more must it hesitate and acknowledge its impotence when called upon to penetrate the secrets of the atom, a million times too small to be seen even under most powerful magnification. Faraday read the ridicule of electromagnetic induction, Maxwell and Hertz set light and electric waves in the same class, Röntgen added the x-rays, and Becquerel the new radiations. Whose task has it been to co-ordinate these widely varied phenomena and show them as applications of simple fundamental laws rather than marvellous exceptions? Who, relying upon the simple laws of the elastic ether, has penetrated the structure of the atom and revealed its secrets? Who has taught and inspired a host of the ablest investigators in physical science? None to an extent comparable with Joseph John Thomson, Cavendish professor of experimental physics in the University of Cambridge, England, whom I have the honor to present, and respectfully request that the Degree of Doctor of Science be now conferred upon him."

In conferring the degree of Doctor of Science, President Butler welcomed Prof. Thomson as "comrade of Maxwell, Helmholtz and Kelvin in the mastery of Nature's intimate secrets, standing as they stood on the outermost edge of the boundary of knowledge."

Mr. Hewitt was felicitously presented by his friend, Prof. M. I. Pupin, and in conferring the degree of Doctor of Science, President Butler said: "Peter Cooper Hewitt, distinguished son of a distinguished father, whom this university will always delight to honor, scientist and inventor of exceptional insight and skill, I gladly admit you to the degree of Doctor of Science in this university, and confer upon you all the rights and privileges that belong thereto."

The degree of LL.D. was also conferred on President Humphreys, of Stevens Institute, who graduated from the mechanical engineering course of Columbia in 1881. In introducing President Humphreys, Dean Hutton, of the faculty of applied science, said, in part: "A graduate from the mechanical engineering course in 1881, he has shown that this education can fit a man to carry the most exacting burdens of industrial administration and affairs. From modest beginnings he became the founder of important business enterprises which are monuments of his professional ability and his faculty for organization and control. We honor him because of the love and loyalty which he has manifested to his alma mater when at her call and in her need he laid aside the lucrative and expanding opportunities of his chosen path to assume the burden and responsibilities of the presidency of Stevens Institute. We honor him for the energy, the ability, the tact, the courage, the self-sacrificing enthusiasm with which he has assumed these duties aid is now discharging them."

At a luncheon which followed in the Alumni Memorial Hall, Prof. Thomson spoke. He stated that he had been greatly impressed by American universities and still more by the magnificent benevolence showered upon them. "I envy American liberality," he said. "Cambridge University sorely is straitened for funds. It took years of hard work to raise $350,000. It is difficult to interest rich Englishmen in education, while here it seems to be the first interest of the wealthy man. I regret, though, that your enormous gifts for university buildings are not accompanied by corresponding gifts for endowment. A peculiar danger is constituted here by the fact that salaries received by teachers are lower than in any other country in the world. The greatest pleasure is in solving the things which seem to be most obscure, but scientists are kept away from investigation by lack of material reward."

Programme of the Institute Niagara Meeting.

The following is the programme in detail of the meeting of the American Institute of Electrical Engineers at the Cataract House, Niagara Falls, on Monday, June 29, and following days:

Monday, June 29.—Institute and President's day, 9:30 to 1. Address, President Scott. Institute Branch Meetings, their Organization, Development and Influence, by Calvin W. Rice. The Energy Transformation in the Synchronous Converter, by W. S. Franklin. Commercial Alternator Design, by W. L. Waters. Afternoon—Visits to local points of interest. No prearranged programme. Evening—An Exhibition of the Hewitt Converter and the Mercury Vapor Lamp, by P. H. Thomas.

Tuesday, June 30—Electrical Day, 9:30 to 1. Railroad papers: High Speed Electric Railway Problems, by A. H. Armstrong. Storage Battery Industrial Locomotives, by Frank L. Sessions. Predetermination in Railway Work, by F. W. Carter. Car Run Tests, by W. E. Goldsborough and P. E. Fansler. Some Recommendations Concerning Electrical and Mechanical Specifications for Trolley Line Insulators, by Samuel Sheldon and J. D. Keiley. The Storage Battery in Substations, by W. E. Goldsborough and P. E. Fansler. Notes on the Operation of Railway Motors in Service, by Clarence Renshaw. Afternoon, 2:15.—Technical tour of inspection of electrochemical and other electrical installations operated by Niagara Falls Power, and the Power Houses of the Niagara Falls Power Company. Reception by Niagara Falls Power Company on Terrace of Power House No. 2. Evening—Dance under the auspices of Local Committee at Cataract House.

Wednesday, July 1, Niagara Day, 9:30 to 1.—Power Transmission Papers: On the Testing of Electrical Apparatus for Dielectric Strength, by P. H. Thomas. Choice of Frequency for Very Long Lines, by P. M. Lincoln. Methods of Bringing High-Tension Conductors into Buildings, by C. E. Skinner. Y or △ Connection of Transformers, by F. O. Blackwell. The Grounded Wire as a Protection against Lightning, by Ralph D. Mershon. The Operation and Maintenance of High Tension Underground Systems, by Philip Torchio. Electric Cables for High Voltage Service, by Henry W. Fisher. The Use of Automatic Means for Disconnecting Disabled Apparatus, by H. G. Stott. Afternoon—Trolley trips to Niagara Gorge, Fort Niagara, Brock's Monument. Chippewa. Technical visits to following plants: Niagara Falls Hydraulic Power and Manufacturing Company; Canadian Niagara Power Company; Natural Food Company. Evening—Entertainment, Cataract House, under auspices Local Committee and General Committee.

Thursday, July 2, Excursion Day, 9:30 to 1.—Miscellaneous papers: The Factors which Affect the Energy Losses in Armature Cores, by J. Walter Esterline and Clarence E. Reid. Central Station Economies, by W. E. Goldsborough and P. E. Fansler. The Electrical Equipment of a Gold Dredge, by R. L. Montague. The International Electrical Congress of 1904, by Elihu Thomson. The Legalized Standard of Electromotive Force, by H. S. Carhart. Symbols and Nomenclature, by Carl Hering. A Universal Telegraphic Code, by G. C. Squier. The Magnetic Units, by A. E. Kennelly. The Cathode Ray Alternating Current Wave Indicator, by Harris J. Ryan. Some Notes on Certain Underground Hoisting Problems on the Witwatersrand, by A. W. K. Pierce. Afternoon—Technical excursions to Olcott Beach, St. Catharines, Lockport, Tonawanda Substation. Evening—Illumination of Gorge Route.

Friday, July 3, Buffalo Day, 9:30 to 1.—Joint meeting with the Society for the Promotion of Engineering Education. Papers will be presented by the following members of the Institute: The Teaching of Physics to Electrical Engineering Students, by W. S. Franklin. The Problems that are Facing the Electrical Engineer of To-Day and the Qualities of Mind and Character which are Needded to Meet them, by J. G. White. The Proper Qualifications of Electrical Engineering School Graduates, from the Telephone Engineer's Standpoint, by Bancroft Gherardi, Jr. The Proper Qualifications of Electrical Engineering School Graduates, from the Manufacturer's Standpoint, by L. A. Osborne. The Education of the Artist in the Forces of Nature, by E. H. Mullin. Engineering English, by T. J. Johnston. Lunch 1 to 2. Afternoon—Technical trips to Buffalo, Buffalo General Electric Company, Buffalo Terminal House. Adjournment of convention.

The Training of Telephone Operators.

THE OPERATOR'S TRAINING SCHOOL OF THE NEW YORK TELEPHONE COMPANY.

BY HERBERT LAWS WEBB.

A NEW YORK daily newspaper of this date—a date that shall be nameless, for no one shall know how long it has taken me to complete this article—contains a dispatch from an unknown place in the interior of the country, which rejoices in a name suggestive of a heroine of a romantic novel, stating that a wealthy banker of the place "fell in love with a telephone girl who always answered his calls promptly, and they were married this afternoon." Doubtless there is a wealth of romance concealed behind that succinct statement, and it was probably hardly the intention of the industrious reporter who discovered, or invented, the event to lead us to believe that the wealthy banker married the telephone girl simply because she answered his calls promptly. A telephone girl who answers calls promptly is not really a *rara avis,* and, if she were, the average wealthy banker is not so lacking in intelligence as incontinently to marry the first quick operator he meets and so reduce the efficiency of the telephone service. If he really appreciates quick telephone

FIG. 1.—EIGHTEENTH STREET TELEPHONE EXCHANGE AND SCHOOL.

service he would be acting contrary to his own interests in removing from the switchboard to his fireside the giver of it. However, let the story stand for what it is worth; it may result in a marked acceleration of the rapidity of the telephone service furnished to wealthy bankers the country over, and it may help to increase the general efficiency of telephone operators, since none can tell when she may be entertaining an "angel" unawares.

The making of an expert telephone operator is by no means the simple matter that many suppose it to be, and there is far more in telephone operating than the quick answers that captivated the wealthy banker of Muscatine. At its simplest, the operation of a telephone switchboard so as to give a thoroughly efficient and satisfactory service demands an intelligence somewhat above the average, trained and guided by careful tuition and suprvision. But in a large city telephone system of to-day there is such a great variety of possible calls that may be made—local, suburban and long-distance, direct-line, party-line, public station, private branch exchange, and so on—and this great and ever-increasing variety involves the use of so many different signals and tests, each having its proper place in the general scheme for the rapid and accurate handling of the traffic, that the demands made on the capacity of the expert operator are far more exacting than anyone not familiar with the inside working of a telephone system would readily believe. With the growing complication of the modern city telephone system and its traffic there has arisen a necessity for giving the operators a regular course of preliminary training and tuition before entrusting them with any part of the actual work of operating subscribers' lines.

The method of teaching telephone operators their work formerly followed was to allow the learner to "listen in" at a working operator's position and to watch the handling of the plugs and keys and the display of signals, picking up what explanation she could of the meaning of these movements from the orders and answers she

FIG. 2.—SWITCHBOARD PRACTICE.

overheard in her head telephone. After a period of this learning by looking on, with a certain amount of instruction from supervisors and chief operators to aid her in acquiring a working knowledge of the switchboard, the learner was placed at a light position, under the wing of an expert operator, and so gradually acquired by sheer practice the confidence and quickness of the full-fledged operator, working up from an assisted position, through night work when calls are few, to an easy day position, until finally judged sufficiently expert to handle a fully loaded position at the busiest time of day. To reach this point usually took the average girl about nine months; as the telephone operator does not, on the average, remain a telephone operator for longer than three years, it follows that a quarter of the total time the operator remained in the telephone company's employ was occupied in teaching her to do her work efficiently.

FIG. 3.—LECTURE ROOM.

All these operators have to be taught their work, as telephone operators rarely travel and do not go from one telephone company to another, so that there is no supply of experienced applicants. Nowadays there is, in addition to the demand due to the rapid expansion of the telephone system, a steady demand for trained operators for private branch exchanges in business houses, but even before this demand arose to reduce the telephone company's force the average time that a girl remained an operator was not more than three years. After three years' service at the switchboard she left to get married, to take up other work, because she was wanted at home, and probably for a variety of other reasons; but

anyhow, she left, and her place had to be filled by the laborious process of training a learner in the manner described.

The new method of training operators is as great an advance over the old as the common battery switchboard is over the magneto system. It consists in passing them through a thoroughly equipped and officered training school, where they are taught how to handle the various parts of a telephone switchboard, how to answer calls, how to complete all the many different kinds of connections that they may be called upon to make, even how to handle an abusive or argumentative or flirtatious subscriber. And as in any other good school these things are not taught simply by rule of thumb, but a good groundwork of theory and underlying principles is given on which to build more firmly the working knowledge of the apparatus that comes by actual manipulation.

The training school for operators of the New York Telephone Company is established in the new Eighteenth Street telephone building, where it has been in active operation for nearly eighteen months, having started in January, 1902, with four students. The school is now arranged to accommodate about 60 learners at a time, and up to the present it has supplied the working exchanges with no less than 825 graduates from its very thorough course of tuition in the science and art of telephone exchange working. The school has a total teaching staff of nine, under the very able management of Miss Katharine Schmitt, one of the company's most experienced exchange employees, who is undoubtedly one of the smartest tele-

FIG. 4.—STUDY ROOM.

phone women in the country. Miss Schmitt has the great advantage for her position of being what no mere man could pretend to be, a very actute judge of womankind; and any young woman who passes her preliminary examinations and tests and then completes the course of training in the school has the best possible certificate of being fit for the work of telephone operating under the stress of New York conditions. Not by any means all, not even a very large percentage of the applicants survive the ordeal. Of the applicants, who often number forty to fifty in a day, not more than about half are found to have the requisite qualifications to justify even beginning to teach them the inner mysteries of the telephone system; and of those who pass the preliminary examination as to character, education, physical and mental fitness, from thirty to forty per cent. drop out in the sifting process that goes on in the first week or two of tuition. On a broader scale, it is much the same as with the fire horses; either a girl shows from the beginning that she has an aptitude for the work, or she shows within a week or so that she has none, or so little that it is not worth while to expend time and labor on teaching her work at which she will never become expert.

From this point of view alone the school has an enormous value, as it eliminates entirely from the exchanges the raw student element, which previously made a serious draft on the time and attention of the supervisors and chief operators, and also constituted more or less of a clog on the service. Further, the school provides means of testing a beginner's capabilities and general aptitude for the work very much more effectively and quickly than was possible under the old system of training learners in the exchanges. The general result of the school system is this: After a month's training in the school the graduate is a more efficient operator than was formerly obtained after three or four months of the "listen-in-and-look-on" method; and the training school graduate after about four months in the exchange is a full-fledged expert operator. So that in about five months' time the new system produces the result that formerly was estimated to take about nine months, and produces it with much less trouble and friction both inside the exchanges and between operator and subscriber. Nor does this tell the whole story. It was reckoned that nine months' training were necessary to produce an expert operator a few years ago, when the system was smaller and simpler and the standard of service somewhat lower than it is to-day. The tremendous development of the system has brought with it a corresponding increase in the variety of calls that may be made, and this, coupled with the steady raising of the standard of efficiency of service—implying both an increase of smartness and an increase of accuracy—makes a greater demand on the intelligence and capacity of the operator than was made a few years ago. So that the expert operator of to-day is a bit more of an expert than she of a lustre ago. She does more work and quicker work and more accurate work, and, thanks, to the school, she learns to do it in not much more than half the time that was formerly necessary.

The first step in dealing with applicants is to test their general fitness for learning the work. The usual applicant is a young girl of between seventeen and twenty, living with her parents or relatives, and of whose character or general conduct there is practically no question. In dealing with recruits to a force of young women numbering close on to two thousand and working in groups of between one and two hundred, this is naturally a question that must be put beyond doubt. Many applicants come direct from school with recommendations from their teachers, and the question of a sufficient elementary education—the ability to write, read and understand, quickly, clearly and correctly—is easily settled. The physical and mental qualifications are the next points—a fair height, good hearing and eyesight, and a good voice production and pronunciation are the chief physical requisites, and a quick intelligence and alertness of mind are the mental qualities required, and are easily recognized when present. Unfortunately, they by no means always are present. All these points are pretty thoroughly tested, and those who fail to pass the test may be pretty sure that they have not been superficially or carelessly judged. Miss Schmitt detects those who fall below the standard as unerringly as the automatic balance at the mint rejects light-weight coin.

The successful applicant then immediately begins to learn the routine of work in a modern telephone exchange, and from an applicant passes to the stage of a student. To each student is assigned a locker and a number, by means of which her work may be identified at any time in the future. In this respect it will be seen that the telephone company is consistent, as it gives the operators' numbers as well as the subscribers. The first lecture to a class of learners begins with instructions regarding the hours of duty, the deportment expected of operators when in the exchange quarters and the care of their lockers; it then plunges *in medias res* with a description of the telephone; that is, of the subscriber's station, of the manner in which it is connected to the exchange and of the functions of the exchange switchboard and of the operators who serve it. The description of the telephone system and of the multiple switchboard and its various parts is illustrated by means of admirably executed diagrams and drawings, some of which are reproduced here. Each part of the switchboad is explained point by point, and the students learn how each subscriber's line terminates in its answering jack and signal, how each line may be reached at any part of the board by means of its multiple jacks, and what the various jacks and signals mean. The interest of the students is retained, and at the same time an idea is got of their intelligence and receptiveness, by asking them questions as the lecture goes along, getting them to point out which are the answering jacks and which the multiple and giving them practice in picking out jacks on the diagrams by their numbers.

After this preliminary canter the students are taken to the switchboard and are shown the actual apparatus, the use and nature of each part of the equipment being thoroughly explained. Very careful instruction is given in the handling of the cords and plugs, and the students are specially cautioned against the vicious practice —the cause of so many cord troubles—of pushing plugs in and pulling them out by the cords. The use and proper manipulation of the combined listening and ringing key is explained and illus-

trated by the instructor, and the function of the supervisory lamps and their relations to the cords made clear. After this object lesson, the impression it has made on the students is tested by asking them to name the different parts of the keyboard equipment and to describe their use.

At the next lesson, the students enter upon the science and art of telephone operating, and learn how to answer calls and how to

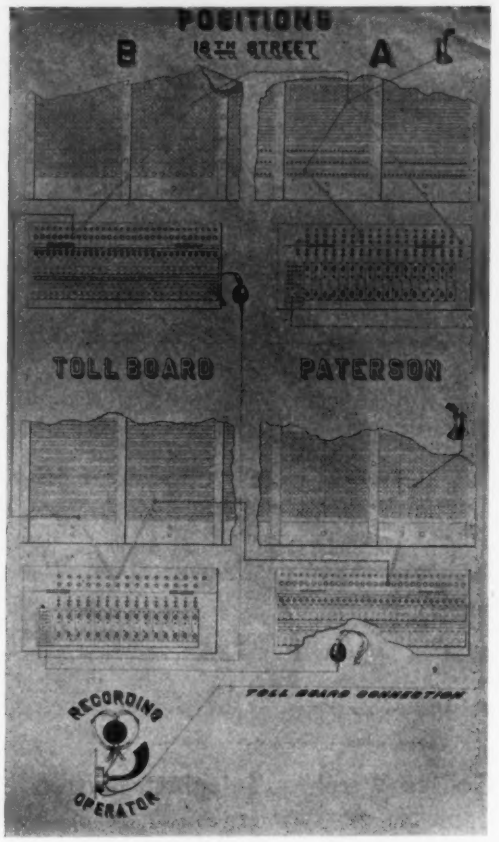


FIG. 5.—DIAGRAM OF A TOLL CONNECTION.

check the number asked for by subscribers. Particular attention is given to teaching the students to answer in a brisk and business-like manner, and this important little detail is illustrated by the instructor, who makes very plain the difference between the tired and lackadaisical manner that makes the subscriber's heart sink and the clear, brisk tones that inspire the subscriber with confidence in the efficiency of the operator. It is just such points as this that illustrate the thoroughness and intelligence of the system of tuition. The actual operation of the switchboard is then gone into more fully and the meaning of the supervisory lamps is thoroughly explained and illustrated by practical demonstration. The students are taught to supervise entirely by means of the lamp signals, and thus it will be seen that New York is in course of acquiring a race of telephone operators who will never have learned to use that distressing phrase, "Are you through?"

From this point on the student gets daily deeper into the mysteries of a large telephone system. The succeeding lectures of the course deal with the various signals on the line lamps, indicating different classes of service, with the recording and checking of messages, with the "busy" test and all the troubles and embarrassments liable to arise from it if it is disregarded or if the calling subscriber is incredulous and persistent—not an unknown occurrence. Next the students are made acquainted with the methods of trunk working, and with the various signals on the multiple jacks indicating private branch exchanges, numbers changed or discontinued, and so forth. Were I to set out in detail the extent and variety of the information which a telephone operator in a modern and extensive system is required to absorb in order to fit her for her work, it would make quite a formidable list of items. And to become thoroughly efficient and useful she must not acquire this knowledge merely superficially, but must get it accurately and firmly fixed in her mind, every detail thoroughly mastered so as to be ready for any of the thousand and one different demands that may be made on her in the course of a day. If a mechanical operator could take a tour through some of the New York exchanges and observe the immense variety of calls that are made, it would throw itself on the nearest scrap-heap in despair.

In the course of tuition the lectures illustrated by diagrams alternate with practical work at the switchboard. The lectures cover all the general principles of the work of exchange operating and management and organization; the districts into which the city and neighboring territories are divided are described and illustrated in dealing with trunk working; the organization of the exchanges is fully shown in explaining to the operators their relations with the supervisors, monitors, chief operators and managers and the assistance they are to expect from them in the course of their work; the methods of reaching out-of-town points and of dealing with the various special calls and difficult connections are all duly explained and illustrated by precept and example.

The working part of the school consists of a fully equipped common battery switchboard of twelve *A* positions and two *B* positions. This switchboard is fitted with every variety of appliance and signal that is to be found in the regular exchanges and is capable of dealing with every variety of call likely to be originated in the actual working of the general system. The subscribers are represented by a number of supervisors, seated at desks overlooking the switchboard. These desks are equipped with telephones and with a number of lines connected to the switchboard. These representatives of the public pour in upon the students a steady stream of calls of all kinds, and they enjoy the highly original experience of making telephone calls and actually watching the handling of them. And let it not be imagined that these supervisor subscribers make merely perfunctory calls that are always easily handled. By no means. They test and try the learners in every possible way, even to the extent of trying to make them lose their tempers by arguing with them and by

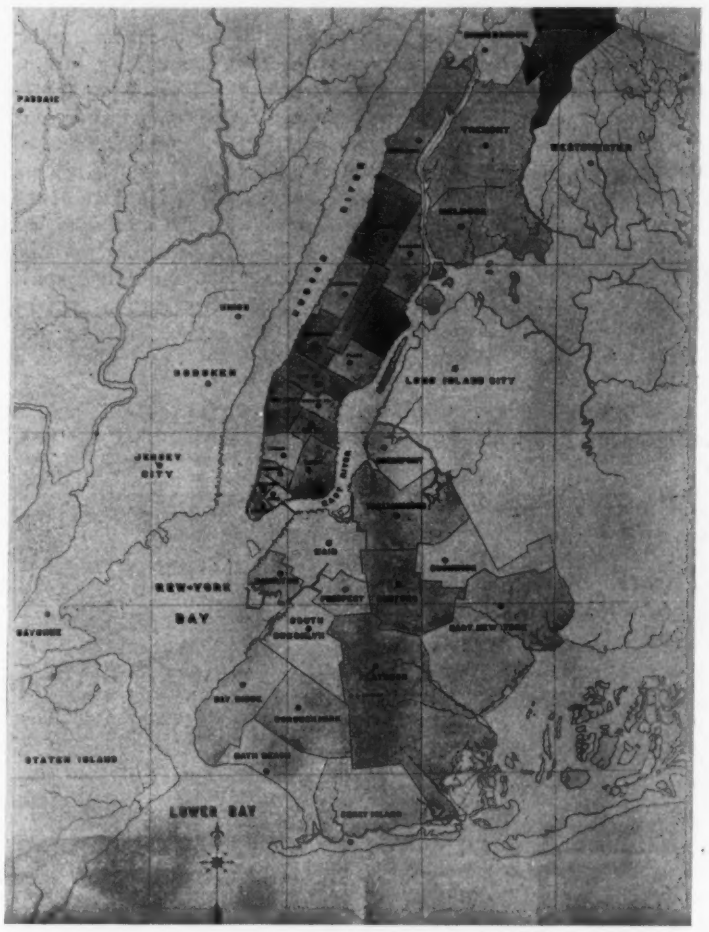


FIG. 6.—MAP OF NEW YORK TELEPHONE DISTRICTS.

affecting to disbelieve "busy" reports! Being experienced operators themselves, they know well the little difficulties that telephone users sometimes create, and all of these they practice on the learners—to prepare them for the "real thing." Patrolling the switchboard itself are other supervisors, in their own parts, watching the work of

the student operators, helping them with difficult connections, correcting their errors and instructing them in each new detail as it comes up. It can readily be imagined that after a few weeks of such very practical practice as this, a student who has any real aptitude for the work is in a fair way of becoming a well-informed telephone operator, with a certain amount of confidence in herself and with a good working knowledge of the apparatus she has to deal with in the actual exchanges.

When she graduates from the school to the exchange she finds exactly the same apparatus as that which she has been handling in practice, the same methods, the same discipline, the same accommodations and general surroundings, only all on a larger scale and doing real business for the great and exacting public. She is like a sailor boy transferred from a training ship to a man-o'-war in commission that sails the deep blue sea and meets fair weather and foul, and has to be worked and trimmed and tended and navigated at all hours of the day and night. In either case, if the right training has been given to the right material, she or he soon "shakes down" and takes up the real work in a workmanlike way.

In dealing with a class of work where so much depends on scrupulous and accurate attention to almost innumerable details it is difficult to give a fair description without going into detail to an extent that would threaten to be tiresome. However, I think I have said enough to show that the organization and conduct of the school are throughout characterized by the motto of the New York Telephone Company, "Thorough." The combination of theoretical instruction and explanations in lectures and by diagrams with the actual practical working of a switchboard of exactly similar type to those used in the exchanges is most happily and judiciously carried out. To a large extent, the girls are led to teach themselves, by arousing their interest in the work and encouraging them to ask questions on all points where they feel any doubt. As a general result a course of four or five weeks' training in the school puts the student operator on a rather surer and more stable footing of efficiency than four or five months' training in the exchanges under the old method. The school-trained operator is not only just as expert in the manipulation of the apparatus after four or five weeks in the school as the learner in the exchange formerly was after four or five months, but she is better grounded in the general conduct of the company's business and in the broad principles of the big system with which she has to deal. She has somewhat the advantage of the man who has been to college, as compared with the man who has just picked up his training as he went along. Moreover, as Mr. Sherwood pointed out in the recent Institute discussion on telephony, the training school course provides the exchanges with a staff of operators who have acquired a uniform method of working, and this is a noticeable advantage in the conduct of the service as a whole.

In Mr. Sherwood's recent contribution to the Institute discussion on telephony, he summed up admirably the advance that has been

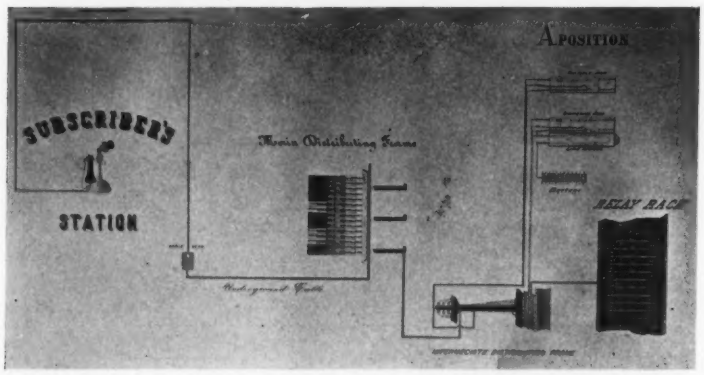


FIG. 7.—DIAGRAM OF SUBSCRIBER'S LINE.

made in the operating efficiency of the New York telephone service by the general adoption of the relay system, and also summarized the advantages gained by the institution of the training school. In one very interesting remark he answered the question that might be asked as to why, if a training school is so beneficial, was it not established before. Until the end of 1901 the switchboards of the New York system were not of uniform design or method of working. So rapid has been the progress of telephone engineering that there have always been two or three different styles of exchange equipment in use at New York at the same time. The Eighteenth Street exchange, for instance, has been rebuilt three times in less than 12 years—in 1889, in 1894, and in 1901. Since 1898, when the first relay exchange was put in service, there have been distinct styles of switchboard in use, the relay system, the magneto with self-restoring drops, and the magneto with manually-restored drops, and an operator accustomed to any one of these would be more or less a stranger to either of the others. Consequently a central training

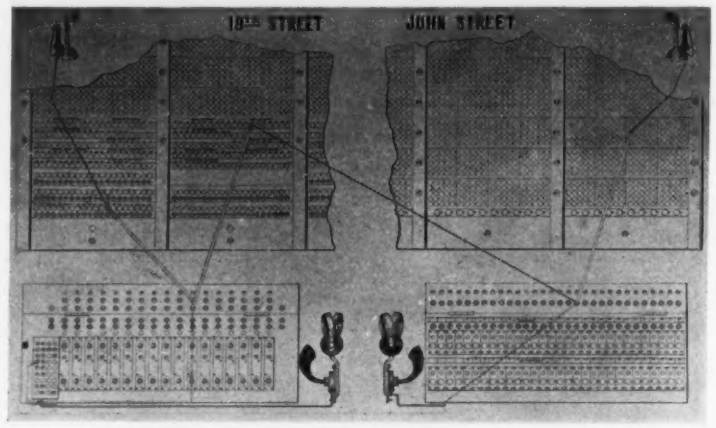


FIG. 8.—SECTIONS OF MULTIPLE SWITCHBOARD.

school would have had a somewhat complicated job to cope with, involving a course in "classics," an intermediate course, and a modern course. The complete reconstruction of the plant on the relay system, finished at the end of 1901, gave the whole service of Manhattan Island—for the first time in its history, I believe—a uniform method of working throughout. It then became possible to establish a training school to teach a uniform method of operating, and the school started its course at the beginning of 1902.

Collins Wireless Telephone System.

BY DR. T. BYARD COLLINS.

THE electrical equipment employed by A. Frederick Collins in his recent tests of wireless telephony between moving ferryboats on the Hudson River is shown in the accompanying illustrations. The instruments are the ones used at his Rockland Lake proving grounds the preceding summer, and by which he was

FIG. 1.—TRANSMITTING AND RECEIVING APPARATUS.

enabled to transmit and reproduce articulate speech to a distance of a mile without wires.

The apparatus is complete in every detail, being arranged to send and receive telephone messages and with calling and indicating appliances as in the case with the regulation telephone. The wireless telephone partakes of the nature of both the wire telephone and the wireless telegraph and the apparatus is similar to a combination of these prototypes, if we make one or two exceptions.

In assembling these parts the arrangement is such that alternating currents are set up in the system which describe pure sine wave curves, and are, therefore, opposed to and eliminate the obstacles that have prevented the adoption of high-frequency currents with maxima decreasing in geometric progression as produced by the disruptive discharge. An objection to this method of compromising low-frequency alternations of the ordinary telephone and the high-frequency oscillations of the wireless telegraph by introducing a

FIG. 2.—RECEIVER.

mechanically high-frequency current in the wireless telephone may be made on the ground that its carrying capacity is limited when compared with telegraphy without wires, and this will have to be admitted for the present, but an increase in distance is only a matter of evolution, just as it has always been with devices for the transmission of intelligence.

There are some inherent difficulties in this extension of distance in wireless telephony not found in wireless telegraphy, for in the former the ordinary transmitter will only carry a current of a certain critical value which, if increased, will burn out, whilst in wireless telegraphy there is practically no limit to the amount of energy that may be radiated.

The experimental researches of Mr. Collins in seeking the best means for the transmission of speech without wires are interesting, since he began with the conductivity and has run the whole gamut up to the Hertzian wave method. In this way he became familiar with the merits and limitations of all the different means to the

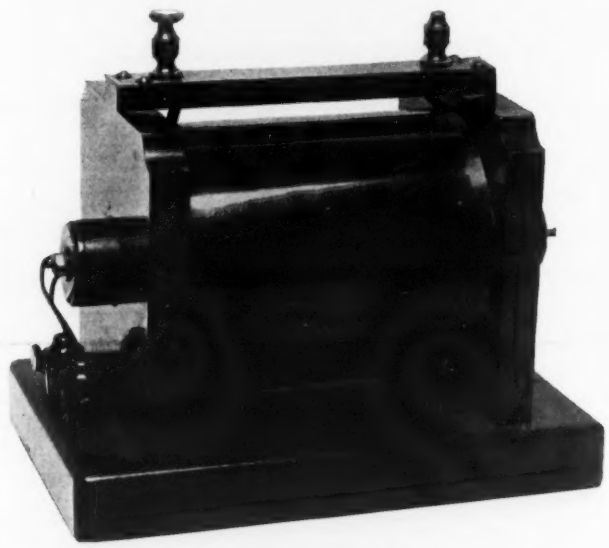


FIG. 3.—TRANSFORMER.

end of wireless telephony. In his investigation of Hertzian wave phenomena he slowed down the high-frequency oscillations until they registered a periodicity of only a thousand per second, when the emitted waves were of correspondingly greater length, so long in fact, that it was indeed difficult to determine whether they were transverse vibrations in the ether or longitudinal current thrusts.

In producing these phenomena Mr. Collins damped down the oscillator circuit by the addition of capacity using a battery of Leyden jars for the purpose and sustaining the relation of the coefficients by adding inductance formed of coils of fine wire; as the frequency of oscillation slowed down to a period equal to mechanical vibration, the telephone receiver responded and without the intervention of a coherer or other wave-detecting device, and the period of alternation at which it operated the best was between one and two thousand.

In these experiments a closed circuit oscillator and resonator was employed so that the oscillations would be rendered as persistent as possible; now what with the damping factor, the low-frequency and the closed circuit, it is evident that distance could not be bridged to any great extent, yet sufficient to show that there was a germ for a system of wireless telephony which, properly cultured, would be of service for places where a few thousand feet would suffice.

Another line of research by Mr. Collins and one that not only interests in its new phases, but which gave evidence of long-distance wireless telephony, was carried out by causing the discharge to take place in the earth instead of in the air, thus eliminating some of the disadvantageous features of very rapid oscillations such as occur when a high-potential circuit is discharged across an air-gap.

In this case two terminals were earthed, but it must not be inferred that the method is that or similar to that employed in con-

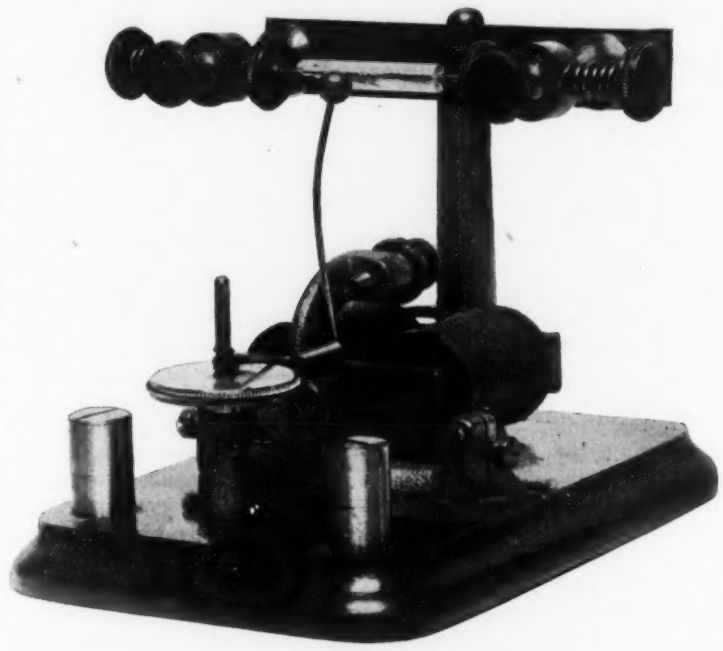


FIG. 4.—COHERER AND TAPPER.

ductivity experiments—in fact, there is as much difference between the two as there is in obtaining electric oscillations by a disruptive discharge and low-frequency, high-potential currents by separating the spark balls to a point beyond the sparking capacity of a coil. In the experiments above referred to the terminal plates or spheres were placed very closely to each other; that is to say, from one to three feet. The energy propagated is of course in the nature of current impulses, but the distance attained with the telephone was far greater than when plates were used in rectangles separated a half of the distance over which indications are to be received, besides possessing the absolutely necessary feature demanded by commercial requirements. The apparatus operates experimentally in free air, but to no effective distance, and in this it follows the analogue of sound; i. e., if a bell sending out its waves can be heard a distance of a mile in free air, it can be heard a distance of twelve miles if struck under water, since water is the denser medium, and similarly with the discharge in the earth. It may be accounted for by the fact that the ether, when closely identified with gross matter, apparently assumes a greater density than in air, and greater in air than in vacuum. To this paradoxical condition the name of *bound ether* has been given, and bound ether has the property of propagating impulses of this nature to much greater distances than ether associated with free air.

As in every other method for the electrical transmission of energy without artificial connection, the impulses are radiated in every

direction, but for the purpose Mr. Collins intends using his wireless telephone, namely, on harbor craft, this feature is far from objectionable, since every vessel within a given radius should be made aware of the presence of every other vessel.

It will be even more difficult to syntonize wireless telephone apparatus than that employed in wireless telegraphy, but in the former secrecy is not a necessity and the first boat that comes into the field of force is the one the wireless telephone is to serve first, just as the first train to enter a block in which there is already a train is the one to receive the signal.

At his Rockland Lake experimental stations Mr. Collins had equipped the first complete wireless telephone system ever operated; it included at either end a sending and receiving apparatus, together with wireless bells for signalling in both directions. Mr. Collins' recent test on the Erie Railroad ferryboats was the first attempt to improve the signalling service of harbor craft.

It seems passing strange, but it is nevertheless true that until Mr. Collins' application of wireless telephony between moving boats there had not been a single improvement for signalling between vessels in harbors since the invention of the steam whistle.

Mr. Collins' wireless telephone is evidently not designed to supplant the wire telephone, even as the wireless telegraph will never take the place of the wire telegraph, but the field of the wireless telephone is enormously large, its usefulness unquestioned, its practicability assured, and its immediate adoption certain.

A Contribution to the Subject of Aging of Sheet Steel.

By Thomas S. Allen.

It is not the writer's intention to go into detail or bring forth any new theory on the above subject, but only to place before the public the results of a few experiments performed along this line at the works of the Bullock Electric Manufacturing Company. As far as can be ascertained from the many recent publications on this subject, aging of sheet steel is supposed to be caused only by heating, and not by magnetic reversals, as was formerly believed to be the case. With this point in view, the following tests were made to see if heating would cause any appreciable increase in the hysteresis loss of commercial sheet steel for armature construction.

The hysteresis of the samples tested was measured with a Ewing hysteresis tester. This tester was not used to measure the hysteresis loss direct, but only to compare the loss of the samples under test with the known loss of two standard samples; this loss is termed the "hysteresis constant," and will hereafter be expressed by that term. The samples tested were each composed of several strips 5/8 in. wide and 3 in. long. Three different readings were made on each sample, six strips being taken for each reading, and the hysteresis constant was deduced from the average of these readings, thus reducing the error of the readings to a minimum. The strips were punched from the sheet with a special punch and die, thus insuring the same shape and size for each strip, and, by taking the same number of strips for each reading, it was possible to get a constant weight and section of iron for every reading on any particular gauge.

The first test was made on six samples, each of which was selected from a different shipment of commercial steel, by this means securing samples that were as widely variable with respect to composition as was possible for us to obtain. The samples were also selected with the object of covering a wide range of hysteresis constant. The hysteresis constant of each sample was very carefully measured, after which they were placed in a drying oven with the temperature varying from about 67° to 125° C. Every few days the samples were taken out and tested. This operation was repeated fifteen times during the complete test, which extended over a period of 180 days. The temperature of the oven was also taken at twenty-five different times, giving an average of 93° C.

The results of these tests were plotted in the form of curves, shown in Fig. 1, with the hysteresis constant as ordinates, and the time the samples were in the oven in days as abscissæ. Each sample was composed of eighteen strips of steel .014 in. thick except sample No. 5, which consisted of twelve strips of steel .025 in. thick. This sample shows an increase of hysteresis constant from .47 before it was placed in the oven, to .863 after it had been in for 150 days, then decreased to .84 in the next thirty days. Sample No. 92, which had a very high constant before it was placed in the oven, did not change any great amount, as it had practically the same constant at the end of 180 days as it had at the start. Sample No. 105 nearly doubled the value of its constant in 110 days, then decreased a slight amount in the next 70 days. It is interesting to note that the constant of sample No. 101 increased very rapidly for the first ten days, and, at the end of 180 days, it had decreased to nearly the original value.

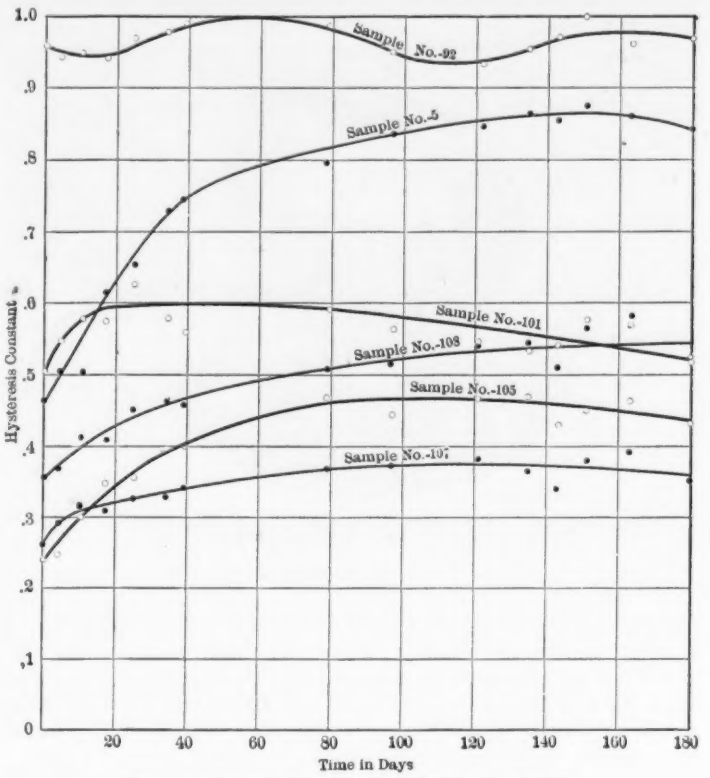


FIG. 1.—CURVES SHOWING RESULTS OF TESTS.

The results of the second test on six other samples are shown in Fig. 2. This test was conducted in the same manner as the first, and as this set of samples was selected from altogether different shipments than the first, a comparison of the two tests shows the aging of different samples to be rather variable.

These tests, although not very extensive, show, as far as they go, that aging is likely to take place in all sheet steel subject to a variable temperature and especially with steel having a low hysteresis constant to begin with. Therefore, if aging takes place at lower temperatures, say about 50° or 60° C., it would seem rather absurd for the dynamo manufacturer to spend his time and money in annealing armature iron.

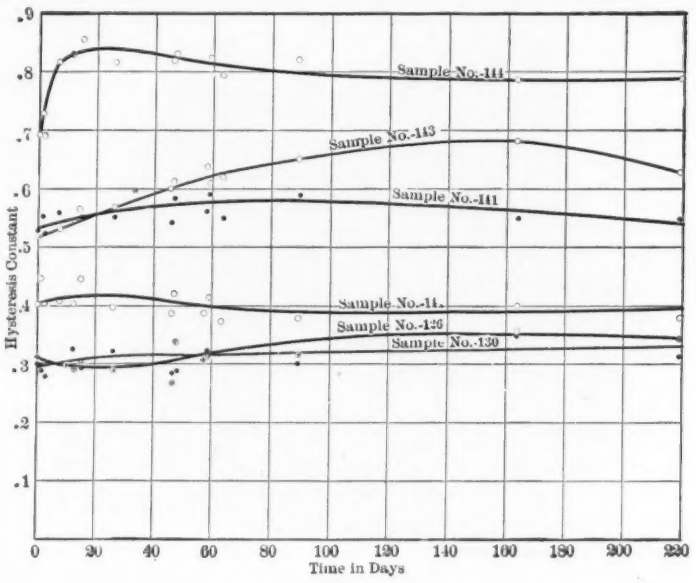


FIG. 2.—RESULTS OF SECOND TEST.

With the present advancement in the manufacture of electrical machinery, and the rigid guarantees which the manufacturer has to meet, it is of the utmost importance that he should know the true quality and composition of the steel to be used. Taking for an

example, the ponderous generating units of from 5,000 to 10,000-kw capacity, the magnetic circuits of which contain thousands of pounds of sheet steel, and on which the guarantees for efficiency are drawn up to the fraction of one per cent., it will at once be seen that the manufacturer is placed in a rather unpleasant position as he has no means of ascertaining whether the iron to be used will or will not increase 200 per cent. in hysteresis loss. There are many cases where machines of the best and latest design are running to-day with a temperature rise of double the amount obtained from the tests made on them at the makers' shops. From these facts it will be seen that no matter how much skill is employed in the design of a generator, this peculiar phenomenon (aging) may creep in to mar all the good points of the design.

The time is rapidly approaching when this matter will have to be settled, for a non-aging iron is absolutely essential for the design of first-class electrical machinery. It is hoped that this paper will help to convince its readers of the vital importance of this subject to electrical manufacturers.

In conclusion, the reader's attention is directed to a paper by Mr. S. R. Roget, B. A., entitled "Effect of Prolonged Heating on the Magnetic Properties of Iron," which was read before the Royal Society on May 12th, 1898. This paper gives the results of very extensive and interesting tests, the method of obtaining the hysteresis loss being the same as was used in the tests explained in this article. From the title of this paper it would be inferred that these tests extended over a very long stretch of time, but, as a matter of fact, twenty-five days was the longest test on any one sample. These tests were also made with steady temperatures, the lowest being 50° C., at which temperature the sample tested aged but little in twenty-five days. The results may have been true for those conditions of temperatures and time, but which we could not compare with the conditions met with in practice. As electrical machinery is called on for wide variations in load, we may expect wide variations of temperature.

Electrical Engineers in the Modern City.

Prof. Harold B. Smith, in charge of the electrical engineering department at Worcester Polytechnic Institute, Worcester, Mass., gave the annual commencement address, last week, in the electrical laboratories, before the members of the Engineering Society and a number of interested friends of the institute, including many women.

Prof. Smith's topic was "The Relation of the Electrical Engineer to Modern Social and Industrial Progress," and his treatment of the theme was at once popular and comprehensive. Few lectures upon electrical subjects ever given in Worcester have been so thoroughly understood and generally interesting to those not directly connected with electricity or electrical development, as was Prof. Smith's talk.

Supplementing the lecture itself, Prof. Smith threw upon a screen a large number of stereopticon views, showing the methods of power development and transmission, as well as the buildings and machines connected therewith. With the aid of the electrical equipment at the institute, Prof. Smith also gave a practical demonstration of power transmission. This was in fact a most interesting and significant experiment. The high-potential laboratory is located about 1,000 ft. from the lecture room in the Salisbury laboratories. In the former is located Prof. Smith's 500,000-volt transformer, and from it he transmitted current at 120,000 volts, 60 cycles, to his 175,000-volt transformer in the lecture room; while to the secondary of this transformer he synchronized a 10-kw rotary converter on the lecture table, and applied load to the secondary of the rotary. The above voltages were effective values, and the night was damp and rainy. It is said that this is the first time that power for actual work has been transmitted at so high a potential.

With regard to power transmission, Prof. Smith said: "Of the electrical engineering developments of the past 10 years, there are two which are most important in their effect upon social and manufacturing interests, and to which we may devote most of our attention in order that the full significance of their relation to mankind may be fully realized. The first is the long-distance transmission of power, which on the Pacific coast has already wrought an industrial revolution, as it is quietly doing in many of the industrial centers of the world.

"In San Francisco a few years ago the cost of electric current for power and light was 15 cents for 1 hp per hour, while to-day the published price is almost exactly one-seventh of this amount, and it is possible to deliver at the factory on the coast, from the melting snows and glaciers of the Rockies, power for the machinery at a smaller cost than that at which it is possible to produce that power by steam, even though the fuel were to be delivered at the factory boiler without cost to the power producer.

"The power transmission systems of the Pacific coast are developing at a rate which is the best possible demonstration of the accuracy of this statement, as the discovery of fuel oil in large quantities on that coast has caused no decrease in plants for, and actual installation of, plants for the electrical transmission of power to points where such fuel can be had for little more than the bare cost of feeding it to the boiler from an adjacent oil well."

Prof. Smith also remarked: "It has been estimated that the quantity of carbonic acid annually exhaled by the population of New York City is about 450,000 tons, and that this amount is less than three per cent. of that produced by the fuel combustion of that city, so we may expect that, with the removal of this great source of contamination of the atmosphere, even the air of our greater cities will be practically as pure as that of the country.

"This fact, with many others pointing in the same direction, together with the entire possibility of such power transmission from a purely engineering standpoint, make it no unsafe prediction that in the near future many of the large cities of the world will not see coal except in their mineralogical collections.

"The second and more important development to which particular attention should be given, is largely dependent upon this already successful accomplishment of electric power transmission, but has for its field of application the highly important service of railway transportation. The service of our steam railways, contributing so largely to our rapid development as a nation is meeting a new element which has already wrought great changes in methods of transportation in some localities, and is rapidly extending its influences throughout the world. Many of the existing steam railways have failed to recognize the significance of the possibilities of electric railway transportation, and have met its development at every point with vigorous and determined opposition, which in the end can only react upon those maintaining such opposition."

As to what electric roads have done, Prof. Smith said: "During the past year the electric roads of Massachusetts, because of dense city traffic, carried four times as many passengers as did our steam roads, but while we have locally a remarkable development of urban and suburban traffic, a far more significant development has taken place in the States of the Middle West. There electrically operated express trains at high speed span entire States and carry passengers at an average of about 1 cent per mile for each passenger, while paying dividends comparing favorably with those of steam roads operated at a passenger rate of from 2 to over 3 cents per mile. These roads of the Middle West are common carriers and do a thriving freight and express business."

Another Telephone Central in New York City.

Last week the New York Telephone Company opened a new exchange in a new three-story fire-proof brick building at No. 126 Orchard Street, located between Rivington and Delancey. The first floor is occupied by the terminal room. The second floor is used as operators' quarters, consisting of locker room, dining room, reading room, infirmary, clerks' room, toilet room and men's quarters. The third floor is occupied as the operating room. The switchboard statistics of the new exchange are:

Ultimate capacity of switchboard	9,600 lines.
Ultimate number of "A" positions	60 lines.
Ultimate number of "B" positions	28 lines.
Ultimate number of operators to be employed	175 lines.
Present equipment	4,000 lines.
Present number of "A" positions	28 lines.
Present number of "B" positions	14 lines.
Present number of working lines	2,051 lines.
Present number of working stations	2,524 lines.
Present number of employees	71 lines.

The district takes parts of the Franklin, Spring and Eighteenth Street districts, and consists of the block bounded by New Chambers Street, the Bowery, Third Avenue, Thirteenth Street, Second Avenue, Fourteenth Street and the East River. The new exchange will be known as "Orchard."

Simultaneous Telegraphy and Telephony

By CHARLES C. DUVALL.

THE following is a method which the writer has found very convenient and simple to install, whereby a toll telephone line may be utilized for telegraphic service without in any manner interferinng with telephonic communication.

In Fig. 1 the telegraph station, *A*, is shown at the end of a telephone line, the station being installed in the telephone exchange or

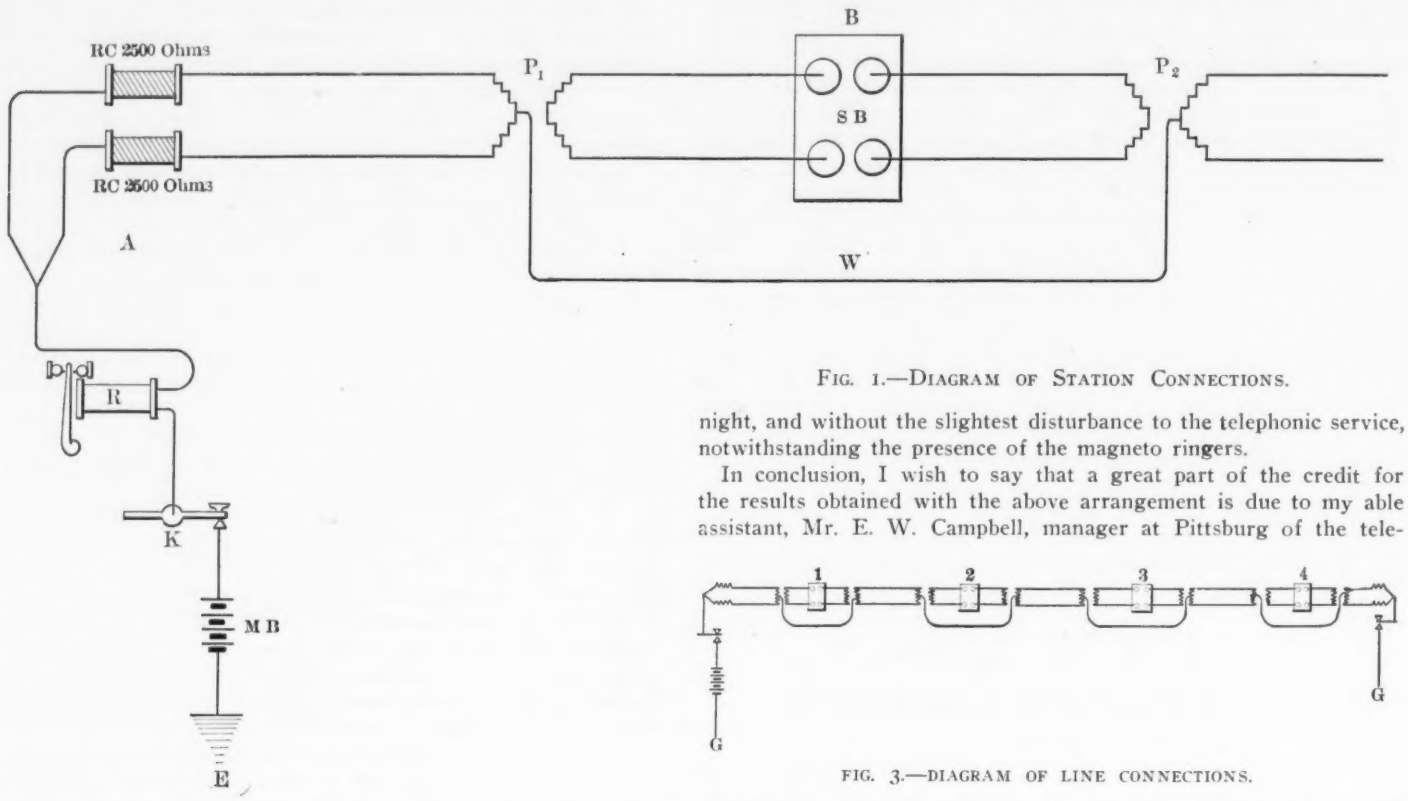


FIG. 1.—DIAGRAM OF STATION CONNECTIONS.

at a distance therefrom. Two repeating coils, P_1 and P_2, are placed in the telephone circuit, one on each side of the telephone switchboard; these coils will naturally be located within the telephone station building. A single wire, *W*, connects the middle point of one side of one repeating coil with the middle of one side of the other repeating coil, the connection being with the outside coil in each instance. The resistance of the repeating coil is fixed by the constants of the circuits. Connected with the outer repeating coil to the left is a telegraphic circuit which contains two resistances, *R C*, in parallel, and the usual telegraphic apparatus; that is, *R*, a relay; *K* the key; *M B* the main battery, and *E* being the earth. The connections of line and bridge are shown more in detail in Fig. 2.

Assume a toll line including four exchanges with the wires dead ended at the switchboard in each exchange; and that it is desired to use the circuits for telegraphic purposes, working between points

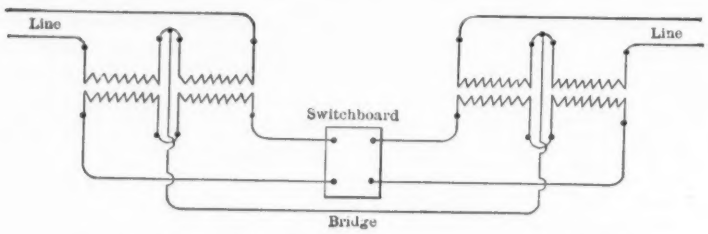


FIG. 2.—DIAGRAM OF CONNECTIONS OF LINE AND BRIDGE.

beyond the two extreme telephone exchanges, as shown in Fig. 3. By connecting around each exchange as above explained, the entire toll line can be used continuously for telegraphic purposes without interfering with the telephonic service.

I am now using a line of 45 miles length connected in this manner. The telephonic service is not interfered with in the slightest, the telephone ringer drops act as usual, and there is no ground noise whatever nor any disturbance from the telegraph signals. It would be an easy matter to cut in four additional telegraph offices in the circuit of Fig. 3, simply by placing a set of Morse instruments in the bridging circuits around the telephone exchanges.

Fig. 4 shows a line I have had in operation for some time, and which is about 60 miles long, and includes three telegraph offices and five telephone stations. The method of connecting is similar to that of Fig. 1, except that in this case the line is used as a party line and the stations are rung up by magnetos, there being a certain number of rings for each station. The circuit is in constant use as a telegraph circuit from 9 o'clock in the morning until 6 o'clock at night, and without the slightest disturbance to the telephonic service, notwithstanding the presence of the magneto ringers.

In conclusion, I wish to say that a great part of the credit for the results obtained with the above arrangement is due to my able assistant, Mr. E. W. Campbell, manager at Pittsburg of the tele-

FIG. 3.—DIAGRAM OF LINE CONNECTIONS.

graph and telephone service of the American Tin Plate Company and the American Sheet Steel Company. Mr. Campbell has rendered

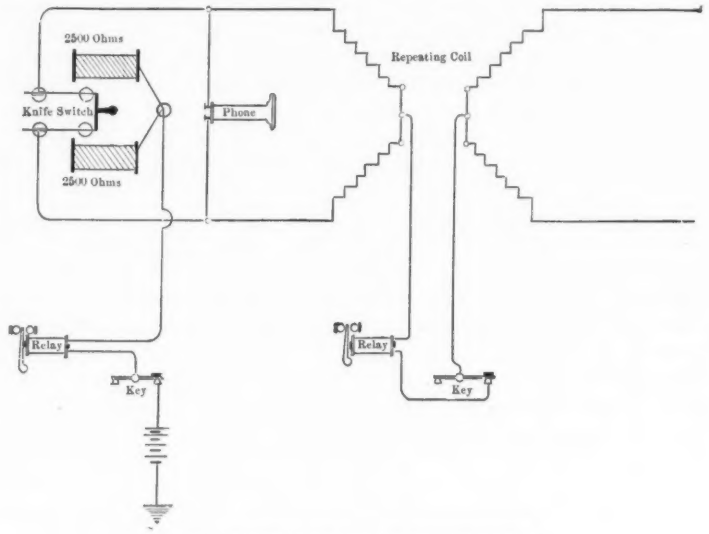


FIG. 4.—DIAGRAM OF OFFICE CONNECTIONS.

me great assistance in obtaining the excellent results in practical work with the method described above.

Contractors' Exhibitions.

In connection with the Electrical Contractors' Association convention, which will be held at Detroit, Mich., on July 14, 15 and 16, and under the auspices of the local association, it is proposed to make an exhibit of electrical apparatus in the Light Guard Armory there, a rental of $50 per booth being charged. Mr. Frank J. Miner is the chairman of the exhibition committee, 207 Jefferson avenue, Detroit, from whom forms can be obtained.

Telephone Exchanges—IV.

BY ARTHUR V. ABBOTT, C. E.

THE second noteworthy point of difference between electricity and magnetism is the fact that there is no such thing as a magnetic *insulator*. Strictly speaking, this statement is true of electricity, for there is no substance that will not allow some electricity to leak, but as the difference between the ordinary conductor and ordinary insulator is many million fold, electrical leakage is too small in most cases to be of serious consideration. With magnetic circuits on the other hand, the curves of Fig. 13 (last issue) show that even under the most favorable conditions the resistance of one of the best insulators (air) is less than 3,000 times as great as that of the best conductor (iron), and as magnetic mechanisms are usually designed, the difference is only a very few hundred fold. With any magnetic circuit, therefore, there is comparatively an enormous amount of leakage, which interferes materially with both the operation and the efficiency of the apparatus.

The tractive effort which a magnet is able to exert is an important consideration in the design of a receiver system. According to Maxwell, the law of magnetic traction may be stated as follows:

$$P = \frac{\mathfrak{B}^2 A}{24{,}642}$$

in which P is the pull in grammes, $\mathfrak{B}$ the flux in gausses, and A the area of one pole piece in square centimetres. In Fig. 13 this relation is plotted in curves E and E'. For curve E the value of B is to be found by scale 1 on the left-hand side of the sheet, while the corresponding tractive effort in grammes per square centimetre is shown by the horizontal scale marked E, commencing at the left hand on the bottom of the sheet and reading from left to right. For example: A flux of 10,000 gausses gives a tractive effort of 4 kilos per sq. cm. As it is difficult to read a lower portion of this curve with accuracy, curve E' is plotted at the top right-hand corner and gives the values of the beginning of curve E somewhat magnified. For this curve the $\mathfrak{B}$ scale is given on the right-hand side of the sheet and designated E', while the corresponding tractive efforts are shown upon the top of the sheet and similarly labeled.

Consider now this theory of the magnetic circuit as applied to the design of the magnetic system of a receiver. For ease in analysis it is convenient to imagine the receiver magnet as an electromagnet, as was actually the case in the older forms; and after the calculations are made, the electromagnet may be replaced by an equivalent permanent magnet without changing the results. Fig. 14 is a diagrammatic representation of such a receiver system, in which $A\,B$ is the diaphragm of soft iron, $d\,d$ the air-gap, or space between the diaphragm and the soft iron bar, $c\,c$, that forms the magnet; $n\,n$ the wire coils on the end of the U-shaped bar, each coil having two windings, one connected to the line, $L\,L$, and the other to the battery, E, which may be supposed to be variable, so that any desired degree of magnetic excitation may be produced in $c\,c$. From the curves E and E' (Fig. 13) it is seen that the tractive force which is exercised on the diaphragm $A\,B$ will vary as the square of the intensity of magnetism in $c\,c$, and at first sight *strength of field* would seem to be the prime requirement. But a little consideration will show that mere pull avails nothing. The office of the diaphragm is to *vibrate* with *changes* in the magnetic field in which it is placed. These changes are caused by the line current which traverses the coils $n\,n$, therefore, the condition of the magnet $c\,c$ must be such that the smallest impulse from the line will produce the greatest change in the magnetism of $c\,c$, and thus the greatest effect on the diaphragm. Further the condition of the diaphragm must be such that the smallest change produced by $c\,c$ in the field or air space, $d\,d$, will be followed by the greatest possible change in the magnetism induced in the diaphragm, in order to secure the greatest sensitiveness. Now referring to the curves A and A' (Fig. 13), it is seen that soft iron is most sensitive to changes in magnetism when it is placed in a field having an intensity of from three to five gausses. This is the keynote to the design of the magnetic system, for we know that we must create a field of an intensity of 3 to 5 gausses in which to place the diaphragm, and that the bar, $c\,c$ (assuming it to be of soft iron), must be so proportioned that *when* it creates such a field it will itself be magnetized to such a pitch as to be the most sensitive to the line current changes, or in other words, both magnet and diaphragm must be in unstable magnetic equilibrium. From the curve this intensity, it is seen, must not exceed 10,000 gausses. Let us now take some dimensions, say such as resemble those found in practice, and calculate what the magnetic system should be. Assume the diaphragm to be 2¼ in. (5.72 cm) in diameter, and .014 in. (.03 cm) thick. Suppose the air space to be 3/64 in. (.12 cm) wide and the magnet to be .25 in. thick x .625 in. wide, with a length of 9 in., measured around the bar from d to d. The cross-section of the magnet will then be .156 sq. in. (1.01 sq. cm, say 1 sq. cm) and the length 23 cm. If the distance between the centers of the pole pieces be taken at ½ in. (1.27 cm), the portion of the diaphragm in front of the magnet that acts as an armature and is included in the magnetic circuit will be 1.59 x .03 = .048 sq. cm. This is on the assumption that there is no spread of the magnetic induction between the ends of the pole pieces and the diaphragm, but the magnetic flux will fan outwards, in all directions, particularly across so wide an air-gap, so that it is conservative to assume that practically the theoretical cross-section will be much increased, say 50 per cent. The diaphragm, then, must be credited with a section of say .075 sq. cm and a length of 1.27 cm between centers of the pole pieces. To secure maximum sensitiveness the magnetization must not exceed 10,000 gausses. Hence the flux in the diaphragm

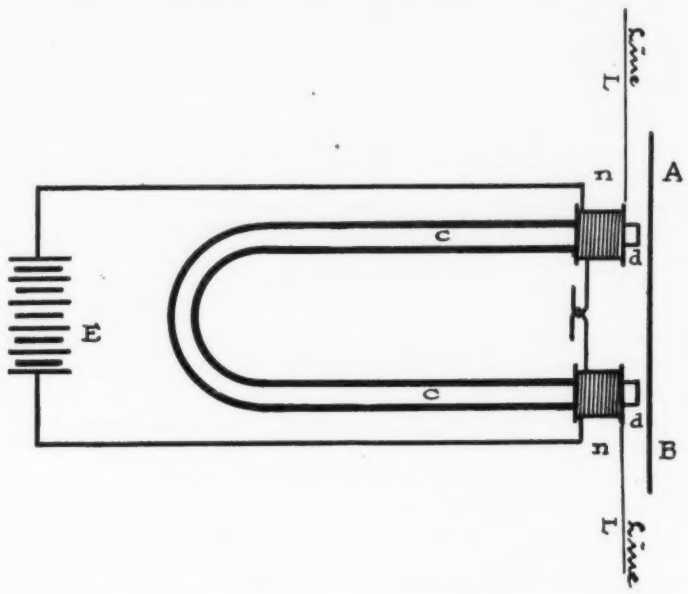


FIG. 14.—DIAGRAM OF RECEIVER MAGNETIC SYSTEM.

will be 10,000 × .075 = 750 maxwells. As the magnet is a long U-shaped bar, whose adjacent sides are close together, leakage will be very great. A rough estimate of probable leakage may be made by considering the relative resistances of the path through the air-gap and diaphragm, and that offered by the air space between the parallel sides of the magnet. These sides are 1.56 cm wide, 11.5 cm long (the mean distance around the magnet through its center) and .95 cm apart; then the area of the flat sides of the magnet between which leakage will take place is 1.56 × 11.5 = 18 sq. cm. The resistance of this path will be $\frac{.95}{18}$ = .053 oersteds. Between the poles and the diaphragm there are two air-gaps, each of which may be regarded as having the same area (1 sq. cm) as the pole opposite to it, and a length of .12 cm. The resistance of the air-gap will then be $\frac{2 \times .12}{1}$ = .24 oersteds. Therefore, the resistance of the path through the air-gaps is to the resistance of the leakage path as .24 is to .053; or, in other words, but 20 per cent. of the flux through the magnet will reach and traverse the diaphragm. Consequently, the total flux through the magnet will be $\frac{750 \times 100}{20}$ = 3,750 maxwells. From the curve A' (Fig. 13) it is seen that when $\mathfrak{B}$ equals 3,750 $\mathfrak{H}$ is 1.44 gilberts per centimetre of length. As the magnet is 23 cm long, and 1 gilbert is equivalent to 1.257 ampere-turns, or 1 ampere-turn = .796 gilberts, the total required ampere-turns to produce this flux is 1.44 × 23 × .796 = 26.4. As the air-gap is relatively large considerable leakage will take place across the gap,

and it will not be far out of the way to assume that the mean flux through the air-gap to produce 750 maxwells in the diaphragm must be a thousand maxwells. To force 1,000 maxwells through 1 cm air requires a magnetomotive force of 1,000 gausses. The resistance of the air-gap has already been shown to be .24 oersteds, and hence the ampere-turns necessary to drive the desired flux through air-gap will be $1{,}000 \times .24 \times .796 = 191$. In the diaphragm the flux is 750 maxwells, the area is .075 sq. cm and the length 1.27, so the flux density is 10,000 gausses, to produce which curve *A* (Fig. 13) shows that 5 gausses per linear centimetre must be provided, hence the amp-turns to produce the flux in the diaphragm will be $5 \times 1.27 \times .796 = 5$. The magnetomotive force then required for such a magnetic system will stand as follows:

	Gausses.	Ampere turns.
Magnet	33.2	26.4
Air Gap	240	191
Diaphragm	6.4	5
	279.6	222.4

From curve *E'* (Fig. 13) it is seen that a flux of 3,750 maxwells per sq. cm will produce a tractive effort of 580 grammes per sq. cm. As the total area of the poles is 2 sq. cm, the tractive effort will be $2 \times 580 = 1{,}160$ grammes (about 2.3 pounds), and it is a common specification to require telephone receiver magnets to lift a two-pound weight.

In order to facilitate the interconversion of gilberts and ampere-turns, two lines are drawn on Fig. 13 to the top corners of the sheet. These lines are designated "ampere-turn curves," *Z* and *Z'*. The curve *Z* is to be used with the $\mathfrak{IC}$ scale on the bottom of the sheet at the left hand, and scale 2 as a vertical scale. For line *Z* this scale 2 reads directly, but for *Z'* it must be divided by ten. For example, to find the ampere-turns equal to 30 gilberts follow a vertical from 30 as the lower left-hand scale to the curve *Z*, thence a horizontal to scale 2, finding 24. Also to find ampere-turns equivalent to 8 gilberts, follow a vertical from .8 on theright-hand lower scale to curve *Z'*, thence a horizontal to scale 3, finding 6.5; divide by ten, obtaining .65.

In the hypothetical magnetic system of this example a battery has been imagined as furnishing the exciting magnetomotive force, because the calculation of the necessary quantity of magnetomotive force was by this artifice rendered more simple. The only other source of magnetomotive force now at our disposal is that of a permanent magnet. As we are utterly in the dark as to the mechanism whereby a magnet is able to act in this fashion, the estimation of a magnet to emit a definite quantity of magnetomotive force is correspondingly obscure. By measurement it is possible to determine the amount of flux any magnet emits, and it is perhaps justifiable to assume that if the magnet produces this flux it can in some mysterious way develop the magnetomotive force necessary to create and maintain the ether stream represented thereby. Experiment can show how much flux can be developed in steel magnets per unit of area. Hence the proper size magnet is determined by dividing the desired flux by the unit flux thus ascertained. The chief practical material so far discovered from which it is desirable to make permanent magnets is steel, and experiment shows that average specimens can rarely be depended upon to develop a flux of more than 3,000 to 5,000 gausses. The preceding calculation has shown that it is necessary to obtain a flux of 3,750 maxwells for this system, and that 224 ampere-turns were required for the purpose. If, therefore, for the soft iron bar, coil and battery of Fig. 14 a permanent magnet be substituted that contains 3,750 maxwells, the same effect should be produced, and the rest of the system will remain as previously calculated. On the basis of 3,000 gausses a magnet of 1.25 sq. cm would be needed.

Traction in South Africa.

A correspondent or the *Iron Age* says that electric operation of railways seems to be the *mot d'ordre* in South Africa just now. Sir Percy Girouard foreshadows a new departure in the electrification of the Transvaal railroad system. An initial scheme is to electrify the east and west railroad services for passengers only, coal being obtained for generating purposes alongside the line, and a suitable site for the power station being naturally indicated at the colliery. If electric trains are adopted it is possible that the present trains of seven or eight carriages running every hour will be changed into short electric trains with a half hour or 20 minutes' service. The population of this portion of the Rand is increasing at such a rate that the innovation should pay for itself even at low fares.

Recent Progress in Wireless Telegraphy.

On June 9 a number of interesting patents were granted for improvements in wireless telegraphy, one to Reginald A. Fessenden and three to Lee de Forest.

Prof. Fessenden's patent relates to an apparatus by which he is enabled to obtain from a direct current source any desired number of discharges per second across a discharge gap used in the production of electromagnetic waves. Heretofore when direct current has been used for producing electromagnetic waves for wireless telegraphy, the practice has been to use an induction coil together with a mechanical break or a Wehnelt interrupter; but for mechanical and other reasons neither break enables one to get any desired number of discharges per second; moreover, in the case of the Wehnelt interrupter the action is not uniform. For these reasons it has been difficult to obtain a continuous stream of electromagnetic radiation, such as is adapted to be used with a cumulatively acting receiver or with a telephone transmitter. In addition the lack of ability to produce any desired number of discharges per second has rendered it difficult to carry out the method of tuning in which groups of waves of predetermined group frequency are sent out and a receiver is thereby operated which is tuned mechanically or electrically to the group frequency. The important feature of Fessenden's new wave generating apparatus is that no break is used, so that there is no necessary appreciable interval of time between the acts of charging and discharging.

Fessenden's apparatus consists essentially of a direct-current dynamo giving constant voltage (or a storage battery), and in series with it a variable high resistance, a condenser and a variable self-inductance. In shunt with the condenser and the self-inductance there is a spark gap, one terminal being connected to the vertical wire, the other to earth. The drawing which accompanies the patent shows more devices in the circuit, but the elements mentioned above are the essential ones. In operation the dynamo charges the condenser and when its potential has risen sufficiently a discharge across the spark-gap will occur, discharging the condenser and setting up oscillations in the sending conductor. On account of the high resistance in the circuit some time is required to recharge the condenser to sparking potential. Hence the discharge is intermittent and may be made to occur as many times per second as desired by cutting off more or less of the resistance, so that any desired number of discharges per second may be obtained.

The inventions of Lee de Forest may be briefly characterized as an application of the "Lecher system of wires" to the methods of wireless telegraphy. To fully understand this application it is necessary to give a brief outline of the characteristic features of the Lecher system, called so after a German scientist, E. Lecher, who studied this special arrangement of wires for a purely scientific purpose.

The Lecher system (Fig. 1) consists essentially of two parallel wires of equal length *AB* and *CD*, connected each at one end (*AC*)

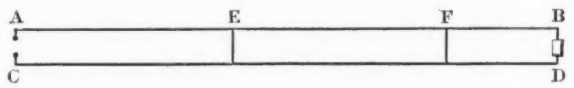


FIG. 1.—DIAGRAM OF LECHER SYSTEM.

to an apparatus producing electrical oscillations of high frequency. If the length of these wires is one-quarter or any multiple thereof of the wave length of the electrical oscillations impressed on the system, stationary or standing electromagnetic waves are set up along the wires, which thus divide up into quarter or half wave lengths with nodes and loops symmetrically situated on each wire. In Fig. 1 the distances *AE* and *EF* are one-half wave-length, *FB* one-quarter wave-length; at *E* and *F* the wave of electrostatic energy forms nodes, at *B* it forms a loop. At the nodes *E* and *F* a conducting body, as a wire bridge, may be placed across both wires, without interfering with the waves; on the contrary, the use of such bridges has the advantage, that if grounded, they lead off waves of another wave-length than that to which the system is adjusted or tuned. At the loop *B* all the energy of the system is electrostatic; therefore, a sensitive device used for detecting the electrostatic wave, such as a coherer, may be placed most advantageously at the static loop *B*.

The electromagnetic wave differs in phase from the electrostatic wave by a quarter wave length, so that the loops of the electrostatic wave are nodes of the electromagnetic wave and the nodes of the electrostatic wave are loops of the electromagnetic wave. A device

for detecting electromagnetic waves such as a bolometer, is placed most advantageously at the loop of the electromagnetic wave.

In such a system of wires the period of vibration is independent of the distance between the two wires and of their diameters; such a system is what is called a "distortionless" circuit. The velocity of propagation thereon for high frequency oscillations is approximately that of light. The Lecher system has been studied thoroughly by various scientists, as it is simple in its mathematical and theoretical aspects; its constants are easily calculated and regulated, so that the dimensions of the system for securing definite results may be readily predetermined.

The most important characteristic features of the Lecher system may be summed up as follows: It is to a high degree a resonant vibrator, that is, it has a very marked period of its own and is very little responsive to oscillations of any other frequency than its own. It is a poor radiator, and consequently a persistent vibrator, persisting for some time in its vibrations once they are set up, therefore producing a long wave-train and damping slowly. By reason of the stationary waves set up higher potentials are obtained than are otherwise possible. The nodes and loops of these stationary waves are fixedly located, thus enabling connections to be made with the wires at any phase of the wave desired. The system may be easily and accurately tuned to any frequency desired. These are the features which make the Lecher system of wires especially suitable for application in wireless telegraphy; on the transmitting station it is possible to obtain with its aid for each signal a longer and better sustained series of waves, while on the receiving end it has other marked advantages.

If the system of Figure 1 is to be used at the receiving station, the coherer is inserted between *B* and *D*, *C* is connected to earth, and *A* to the vertical conductor or antenna, the equivalent length of which is one-quarter of the wave-length of the natural oscillation to which the system is tuned.

For use at the transmitting station, the Lecher system may be arranged as shown in Fig. 2, which represents a "static method of charging." The Lecher wires are shown as of one-half wave-length. Inserted in the bridge across their ends is a condenser. In shunt around this condenser are a spark-gap *S* and the secondary coil of a transformer *T*. When the condenser is charged to the breaking-down point of the spark-gap *S*, a discharge occurs at this point, and this serves as a connecting bridge between the parallel wires, and these wires are set in vibration as a Lecher system. Part of the energy is reflected back at *A* and *B*, forming stationary waves with nodes at *A* and *B*. A part goes into the upright conductor or antenna *AD* and is radiated outward.

A great many modifications are of course possible with the Lecher system in the receiving and transmitting apparatus. For instance,

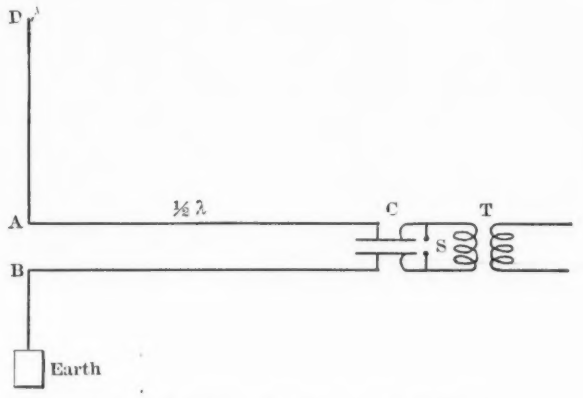


FIG. 2.—DE FOREST TRANSMITTING STATION.

instead of the two parallel wires, the "wire and sheath" arrangement may be used, which consists of a wire surrounded by a coaxial tubular conductor insulated therefrom.

In Fig. 3 the wires *C* and *D* are the simple conductors of the Lecher system, one of them being earthed; the single antenna, however, is replaced by two plates *A* and *B* which may be considered simply as an extension of the Lecher conductors. If the planes of these two plates be parallel and adjacent, the greater part of the energy is concentrated in the field between them. The region of the strongest wave propagation is outward of *A*, and as the plate *B* tends to absorb the lines of force which proceed in its approximate direction, the direction of strongest propagation is perpendicular to its plane. This feature enables the direction of propagation of the effective energizing or signalling waves to be in a measure controlled or directed, or, in other words, provides for the maintenance of a neutral zone or zones. If these plates be mounted so as to be rotatable upon a common axis, the position of these neutral zones may be controlled, and the same apparatus may thus be utilized for signalling in any direction desired, while approximately ineffective in other directions.

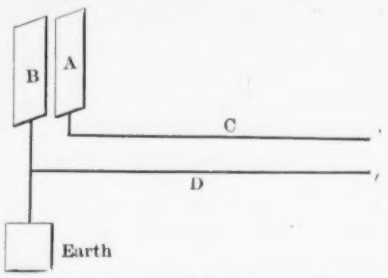


FIG. 3.—DE FOREST METHOD FOR DIRECTING WAVES.

It would, of course, be very inconvenient in practice to use the Lecher system in form of two long parallel wires. De Forest has found that the following convenient arrangement is equivalent to the Lecher system. He twists together the two wires which are insulated, so that they form a twisted pair, the distance between them being regulated by the thickness of the insulation. It is desirable that the pitch of the twist be not too steep. The twisted pair is well adapted to use upon a spool or coiled in any other manner which may be desirable to economize space or to secure portability. In practice the inventor has successfully used such wires with a pitch equal to three turns to the inch wound upon a

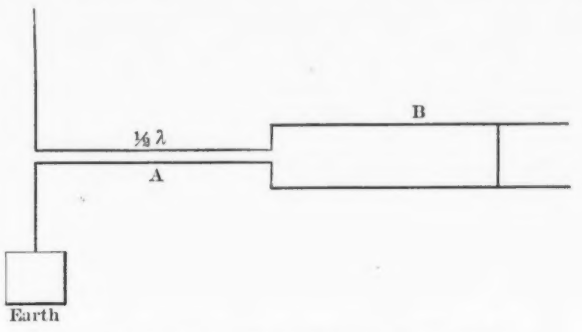


FIG. 4.—METHOD OF TRANSFORMATION OF POTENTIAL.

spool about three inches in diameter with successive turns about an eighth of an inch.

The Lecher system finally enables one to raise or lower the potential by simple and effective methods. It is well known that the mutual induction of the Lecher wires decreases as the two parallel wires are brought closer together and that conversely the capacity of the system is increased at the same time. Consequently if one system of such parallel wires, as *A* in Fig. 4, of a length equivalent to one-half wave length of the vibration transmitted be added to another system, as *B*, of the same period of electrical vibrations, but having its two parallel wires farther apart, then this second system *B* may take up the impulse transmitted from the first system unaffected as to its period of vibration, yet transformed to a wave of higher potential, but of correspondingly diminished magnetic energy or current. Instead of using different distances between the wires in the two systems, one may use the same distance, but embed the wires in one system in a different dielectric from the other; or both methods—change of distance between wires and change of dielectric—may be combined. When desirable to still further increase the self-induction of one of such systems of parallel wires one may insert at corresponding points in each of the two wires inductive or momentum coils of suitable impedance. Each section of the Lecher wires should be of a length corresponding to one-half of the length of the wave of the period to which the system is timed.

A Novel Trolley Pass.

In a recent publication it is reported that President Charles V. Darcy, of the Hoboken (N. J.) Commissioners of Public Instruction, has received a silver match safe, upon which is carved a perpetual pass on all tramway lines in London. The box is one of a number which the Duke of Marlborough had made as souvenirs of his visit to this country several years ago. All the lines in London, however, are not under one management; nor is it quite understood where the Duke gets his power to issue dead-head passes over them.

The Gruhn Telechirograph for Transmission of Handwriting.

On page 561 of vol. 39 (March 29, 1902) of ELECTRICAL WORLD AND ENGINEER, we gave a brief description of a new form of telautograph, invented by Mr. E. Karl Gruhn, of Dresden, Germany. In the following we give a full illustrated account of the construction and operation of this interesting instrument which we recently inspected at the office of Mr. Thomas F. Fitzhugh Lee, of Brooklyn, who, together with the inventor and Mr. M. Herzka, is interested in the introduction of the instrument in the United States.

The instrument is called the "telechirograph" and is a device for transmitting hand-written messages and reproducing them at the receiving station in the hand-writing of the sender; it is to be used in connection with the telephone, and it is stated that apparatus now being built will enable one to telephone and transit a written message simultaneously over the same wire. The device is expected to find great favor with stock-brokers and with the business world in general. While the instruments exhibited at the Brooklyn office are placed there for exhibition only and transmission takes place from one room to another room on the same floor, the method has been used in Germany for transmitting messages from Dresden to Berlin (a distance of about 200 km) and is said to have given entire satisfaction.

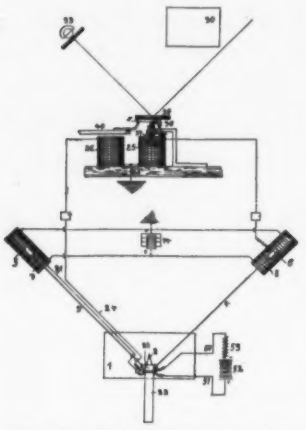


FIG. 1.—TRANSMITTING AND RECEIVING APPARATUS.

The first telautograph was invented by Elisha Gray[1] and the fundamental principle employed by Gray has been adopted by those who followed after him. It is to resolve the motion of the pencil in the transmitting station into two rectangular components, to transmit over two circuits electric effects which are proportional to these two components, and to recompose the two component effects again at the receiving station. The resultant is then a facsimile of the message or design, written at the transmitting station. Gray used current pulsations for transmission. Ritchie, an Englishman, devised a telautograph[2] similar to that of Gray in its fundamental principle. The pen is fixed at the extremities of two links which are fixed to the arms of two otherwise independent rheostats. Each of these is connected through a battery to one of two transmission lines. Currents varying in intensity in accordance with the movement of the pencil on the transmitting station, are sent over the lines. The receiving instruments are virtually two powerful d'Arsonval galvanometers or instruments of the Weston type with locally excited electro magnets. A telephone is employed in connection with the instrument. When the telephone is on its hook, the writing telegraph is connected to the lines; and on removing the telephone the writing telegraph is disconnected and the ordinary telephone connections are substituted. From the reports published as to this instrument, it appears that it is only applicable to comparatively short lines.

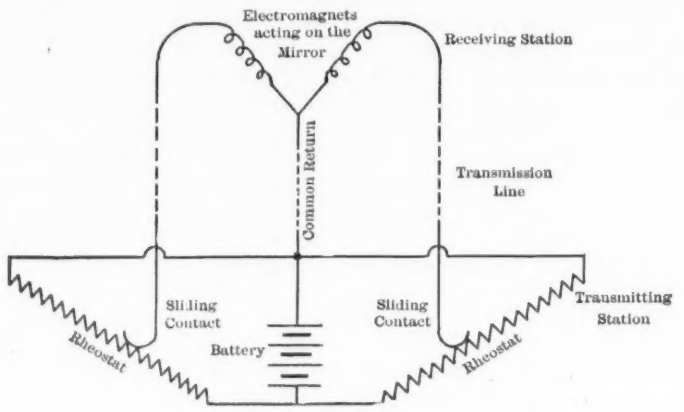


FIG. 2.—DIAGRAM SHOWING CONNECTIONS DURING TRANSMISSION.

The Gruhn telechirograph is in its transmitting devices quite similar to the Ritchie telautograph, but differs essentially from it in the receiving apparatus, in which an arrangement is employed which was used before in the Pollak and Virag high-speed telegraph system[3]. The transmitted currents influence two electromagnets which in turn cause a small concave mirror to move; a light ray from a small incandescent lamp falls upon the mirror which reflects it on a sensitized piece of paper.

Fig. 1 shows the whole arrrangement of both transmitting and receiving apparatus, the former being shown at the bottom, the latter at the top. 1 is the paper on which the sender writes the message, 30 the photographic paper on which the received message is recorded. On the transmitting station the message is written down by means of the pencil 2, and while the pencil moves, the rods 3 and 4 also move and the contacts 5 and 6 at their ends slide on the rheostats 7 and 8, so that parts of these resistances are cut in or out, in conformity with the motions of the pencil. Fig. 2 shows diagramatically the connections while a message is transmitted, each transmission line forms a shunt on the local circuit of the battery. It will be seen from this diagram that when the contacts slide on the rheostat, the currents in the two transmission lines vary; and these are the currents which influence the electromagnets that act on the mirror in the receiving station.

Fig. 3 shows how the motion of the pencil is resolved into two

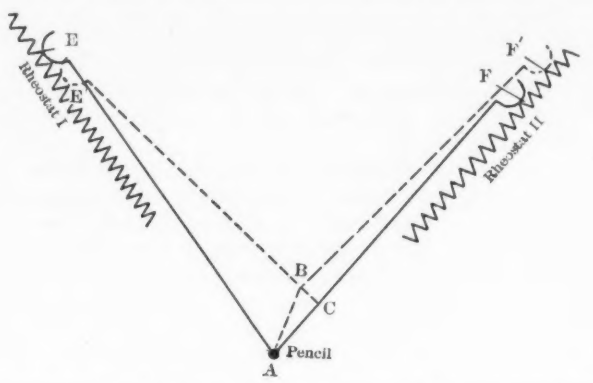


FIG. 3.—DECOMPOSITION OF MOVEMENT OF PENCIL INTO TWO RECTANGULAR COMPONENTS.

components, and how electrical effects are produced which are proportional to these two components. The pencil may first be placed at A, and may then be moved to point B. The sliding contacts move in the same time from E to E^1 and from F to F^1; therefore, the part EE^1 of the rheostat I is cut out of the one transmission circuit, and the part $F\,F^1$ of the rheostat is inserted in the other transmission circuit. We may now assume that the arms AE and AF are very long; if instead of moving the pencil in a straight line from A to B, we first move it from A to C and then from C to B, the lines AC and BC being perpendicular upon each other, it will be seen that $AC = FF^1$ and $BC = EE^1$. In other words, we have resolved the motion AB into two components AC and BC, and the amounts of resistance which are cut in or out from the transmission circuits, are directly proportional to the two rectangular components of the motion of the pencil. Of course, this is exactly correct only if, as supposed above, the rods AE and AF in Fig. 3 (the rods 3 and 4 in Fig. 1) are very long. If they are small, the above argument will not hold good, and there will be considerable distortion of the transmitted signs or letters. It is, of course, important that for practical use the instrument should be of small size, and for this reason the rods 3 and 4 in Fig. 1 should be short. In order to accomplish this, it is necessary to employ some device counteracting the distortion which otherwise would result. The inventor states that he uses such a device, but does not want it to be described at present, as the patent for it has not yet been granted.

The rheostats in the transmitting apparatus are constructed by winding insulated wire in the narrowest possible windings in contact with each other upon a non-conducting core, while the insulation in the path of the sliding contacts is removed from the surface of the spools, but in such a way that it remains between the single

[1] A full illustrated description of the Gray telautograph is to be found in ELECTRICAL WORLD, vol. 21, 1893, page 220.

[2] A full illustrated description of the Ritchie telautograph was given in ELECTRICAL WORLD AND ENGINEER, 1900, vol. 36, page 886.

[3] See ELECTRICAL WORLD AND ENGINEER, vol. 34, 1899, page 34.

windings of the latter. Each winding therefore forms an element of resistance. In Fig. 2 a common metallic return is shown for the two circuits, while in Fig. 1 the earth is used as a return; the inventor proposes to use the lead sheathing of telephone cables for his

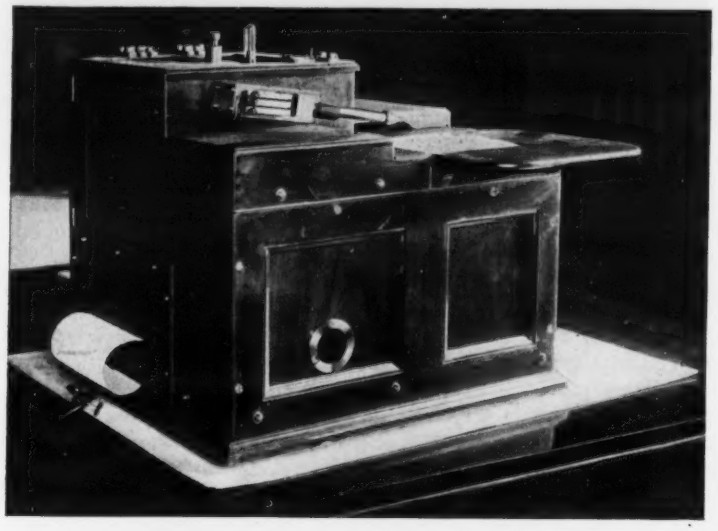


FIG. 4.—TELECHIROGRAPH (PENCIL IN ITS REST).

return circuit. 14 in Fig. 1 is a battery, as is more clearly shown in Fig. 2.

The receiving apparatus as shown at the top of Fig. 1, contains a small electric incandescent lamp 33 which throws its light through a small slit upon a concave mirror, 35, which reflects the light ray to the sensitive paper 30. The mirror is attached by means of cement to a small iron plate 36 in form of a triangle; one corner of the latter rests upon the set-screw 37, upon which the mirror can oscillate. Beneath the two other corners extend two armatures which are subjected to the attraction of the electromagnets 26 and 25; only the armature 40 which belongs to the coil 26, is shown in Fig. 1; the coil 25 must be thought to be behind the set screw 37 in the figure and the armature which belongs to it cannot be seen therefore. These armatures undergo oscillations corresponding to the component movements of the transmitting pencil; they are carried by flat springs, not shown in the figure. For the armatures, permanent magnets are

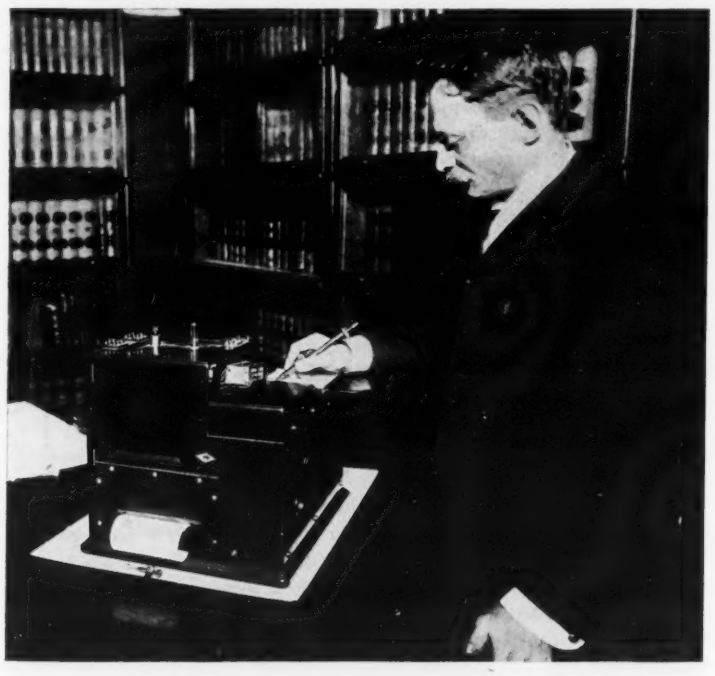


FIG. 5.—TELECHIROGRAPH IN OPERATION.

used, and the iron cores of the electromagnets 25 and 26 are short and do not fill the hollow space of the coils up to the top. A large air space is therefore formed between core and armature, and this fact is said to assure that the oscillations of the armatures are directly proportional to the currents in the magnetizing coils. To lessen the oscillations, oil damping is employed.

The following arrangement is used to deviate the light ray from the sensitive paper when no message is transmitted. Upon the pencil 2 in the transmitting station (Fig. 1) is mounted a sleeve 22, under the influence of a spring adjacent to which a second sleeve 23 is arranged. The sleeve 22 is connected through a wire 21 with the sliding contact 5, while the sleeve 23 is connected through 24 with the transmitting circuit. The pencil is held by means of the socket 22 and guided over the paper. If placed in position to write, the point of the pencil touches the paper first, whereupon the sleeve 22 moves downward and makes contact with the sleeve 23, so that an electrical connection between the wires 21 and 24 is effected; the connections are then those shown in Fig. 2. In lifting the pencil this contact is broken, and the ray immediately oscillates in the direction influenced by the corresponding branch distant circuit to the extreme extent, so that the point of light leaves the sensitive paper. The deviation of the point of light, however, is effected more quickly if the branch distant circuit is not interrupted, but if a relatively strong current in the opposite direction is sent through. For this purpose the battery 52 is provided, whose action is easily understood; when writing, the contact between 22 and 23 is closed and

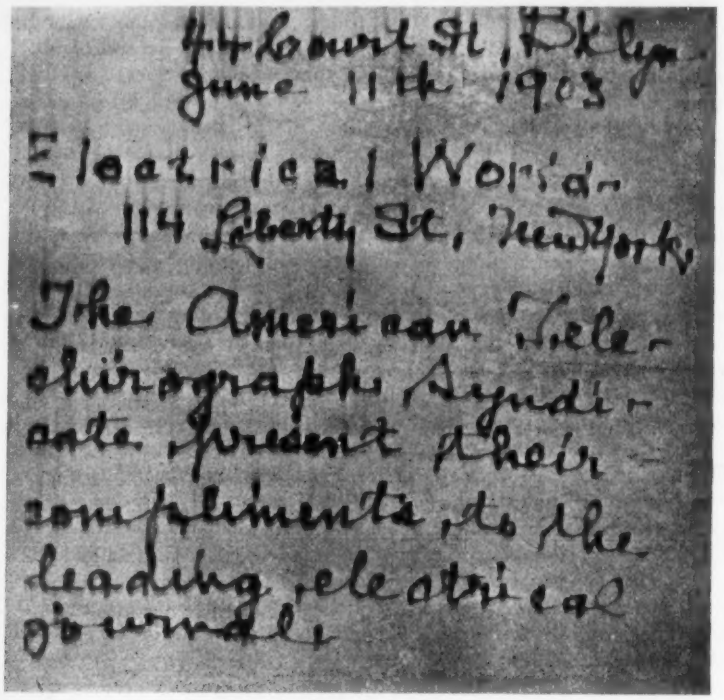


FIG. 6.—SPECIMEN OF HANDWRITING AS RECEIVED.

the battery 52 does not come into action; 53 is a resistance in series with this battery.

In practice, of course, each instrument contains both a receiving and a transmitting apparatus. When a message is completed, a small electric motor operated by an independent battery in the receiving device is set in motion. This motor operates a train of wheels or rollers which draw the portion of the film written upon by the light ray through a developing bath and out again through a pair of rubber drying rolls so that the completed message is delivered about 35 seconds after the sender has replaced the metallic pencil in its rest. In improved instruments which are now being built, this time is expected to be shortened.

Fig. 4 shows the instrument in its present form. It is of the size of an ordinary typewriter box. The parts of interest which can be seen are the pencil and the piece of paper on which the sender writes his message. When the instrument is used at the receiving end, the paper with the photographic record of the message is delivered through an opening near the bottom of the box. The message, reproduced in Fig. 6, was transmitted and received in the presence of our representative. It shows that the characteristic features of the handwriting of the sender are well reproduced by the instrument.

In Fig. 4 the pencil is seen in its rest in the foreground of the upper part of the cabinet; Fig. 5 illustrates an operator transmitting a message. In both illustrations the sheet of paper, seen at the lower corner of the left side, contains the transmitted message when the instrument is used as a receiver.

Thirteenth Annual Meeting of the Canadian Electrical Association.

The Thirteenth Annual Convention of the Canadian Electrical Association was held in the city of Toronto, with headquarters at the King Edward Hotel, on Wednesday, Thursday and Friday, June 10, 11 and 12. The attendance was one of the largest in the history of the Association, and the interest taken in the discussion of the various papers brought before the Convention augurs well for the future of the Association. Aldermen Starr and Ward, on behalf of the city, extended a hearty welcome to the delegates and their friends, which was ably responded to by Mr. A. A. Dion, of Ottawa.

Mr. B. F. Reesor, manager Electric Light and Power Company, Lindsay, Ont., occupied the chair, and at the opening of the Convention on Wednesday morning delivered the President's annual address, in which he bespoke for the papers which were to be read a free and thorough discussion so that the salient points in each might be brought out or criticised and in this way the members present would get the benefit of the knowledge imparted to the fullest degree. This year a new feature, at least to this Association, had been inaugurated, namely, the establishing of a question drawer from which he felt confident, if properly followed up, much benefit would accrue; and following along the lines of the National Electric Association he suggested that a new officer should be elected to be named "Question Box Editor," whose duty it would be to look after questions pertinent to the interests of light and power companies and electricity generally.

During the course of the address he said that during the year just passed the question of long distance power transmission had engrossed the minds of capitalists to a greater degree, perhaps, than at any previous period in the history of this country. Rapid strides had been made in development in this direction and at the present time some very extensive plants were contemplated and under construction, notably around the Niagara Peninsula, and when completed Canada could boast of having some of the largest and best equipped electrical installations in the world. He referred to the progress in connection with wireless telegraphy and said, "Truly electricity has passed its 'infancy' stage"; let the use of electricity be suspended for one day, yes, even for one hour, and our whole commercial, if not our domestic system, would be paralyzed."

He referred to the fact that the tide of municipal ownership was in full flow. Millions of money had been invested in Canada by individuals and companies in lighting and power development, sanctioned, and in many instances induced by the very municipal corporations that were now clamoring or looking with longing and covetous eyes at a business that had been carried from an experimental stage until it had become to all appearances a factor of considerable importance in every day commercial life. He characterized it as a case of "Municipalities gone mad." He thought the experiences of the past in connection with this matter should be an incentive to every person interested in electricity to join the Association and bear a quota of the burden in connection with combatting this movement.

He acknowledged with thanks the cordial invitation extended by the National Electric Light Association to the officers of the Association to attend their annual Convention which had been held a few weeks ago in the city of Chicago, and he was pleased to say several had availed themselves of this pleasure.

The report of the Secretary-Treasurer, Mr. C. H. Mortimer, showed a total membership of 375, a large increase over last year. The report also showed a handsome balance to the credit of the Association.

Professor Owens, of McGill University, Montreal, gave a brief address, during which in the name of the Mayor and Business Men's League of St. Louis, Mo., he invited the Association to co-operate with the American Institute of Electrical Engineers and other similar societies in making a success of the International Electrical Convention to be held there during the Louisiana Purchase Exposition in 1904

Mr. John Yule, of Guelph, presented the report of the Committee on Legislation, which stated that the Committee had met and agreed upon a plan of campaign for defence of the Conmee Amendments which were threatened by a bill which had been introduced in the Legislature by Mr. Downey, M.P.P., for their total repeal, and the Committee were pleased to report that they had been successful in opposing this bill. The committee asked for better financial support from those who were reaping the benefit of the work done, as by the efforts of this committee millions of dollars had been saved to the companies interested.

The question box was conducted by Messrs. Hunt and Dion and proved a valuable source of information to the members.

On Wednesday afternoon a paper on the training of the high tension engineer, prepared by Mr. Paul Lincoln, of Pittsburg, was read by Mr. Charles S. Scott, chief electrician of the Westinghouse Electric Company, Pittsburg, Pa., and president of the American Institute of Electrical Engineers. The paper pointed out that there were two schools in which the electrical engineer could receive his training, but only one in which he must receive a course before he could be called a high tension engineer. Those things which were learned in the schools equipped with professors and laboratories and mathematical text books must be supplemented by the things which could only be learned in the school of experience.

Professor Owen, in discussing Mr. Lincoln's paper, said: "Both Mr. Lincoln and Mr. Scott have outlined the relations which should and in the main do exist between the college and practical work so clearly that remarks by me are hardly necessary. However, it may be said that within comparatively few years there did not exist as complete and satisfactory an understanding between the college people and the outside world as now I am glad to say does exist, due in large part to the interest in college work shown by such men as Mr. Scott, Mr. Lincoln and the officers of the Westinghouse, General Electric, the Bullock and other large manufacturing companies. They now perfectly well understand, I think, that a college does all that it can be expected to do when it, in the short time it has to give to the student, gives him some knowledge of the fundamental principles of engineering which underlie all his future work. The tendency in engineering education now, as far as I am able to observe, is to instruct in the principles. No university that I know of can operate a manufacturing establishment and give to the students a knowledge of manufacturing details. It is quite out of the question. It is most significant, however, that the majority of the larger electric manufacturing companies select their young men almost entirely from college graduates, saying at the same time to me that they do not expect that every man who comes from the college will make an engineer, but that it is the best material from which to draw their men. Now, I believe that there are men going out from the colleges to-day perhaps better trained than they were years ago. To me, as a man connected with an engineering school, I must say, if it is so, it is largely due to the interest and assistance of the outside man. I remember very perfectly the difficulty ten or twelve years ago I experienced in obtaining permission to visit the works of any one of the larger companies. I was fortunate enough to know Mr. Scott, and I got into the Westinghouse Company, where I spent one summer. If you, gentlemen, who own and operate lighting plants desire your engineer to further inform himself about high tension work or some special form of new apparatus that any of the larger companies is manufacturing, you may send him to such a factory and he will be kindly received and be shown everything; and he will go away with very much more information than he had when he came. In line with what Mr. Scott had said you might also send your men on trips of inspection for the purpose of studying local conditions which are similar perhaps to those which obtain in your own plant. If the college education is supplemented by this sort of training you will then have or should have an engineer. The college does not make you an engineer. The college man is not in any sense an engineer, but he is a man who is much more likely to become quickly an engineer than a man who has not had the college training. It is only the beginning of the work. Nothing in the world can take the place of experience."

Mr. Scott and Prof. Owen, who had spoken with reference to the educational and manufacturing end of the subject, were followed by Mr. Black, who spoke with regard to the operating end of a transmission plant. He said he had been very much struck with one remark to the effect that when things were designed and everything planned out so that you would naturally expect it to work perfectly, it did not always work that way. He thought that had been the experience of almost everybody who had had to do with operating electrical machinery. He was very much pleased to notice what Mr. Scott had said about engineers getting together and trying to work together for the benefit of electrical engineers at large. It was certainly gratifying to younger engineers to find men of large experience who were willing to give them the advantage of their experience.

On Thursday morning a very valuable paper was read by Mr. R. T.

E. Lozier on "Variable Speed Motors and Their Relation to New Shop Methods," which was amplified by Mr. Lozier and afterwards discussed very fully by Messrs. Hynes, Gossler, Leonard, Higman and others.

In the afternoon of the same day two papers were read, one by Mr. G. U. G. Holman, of Quebec, on "Some Points Relating to Submarine Electric Power Cables," and another by Mr. J. W. Farley entitled "High-Tension Transformers."

In answer to questions on his paper, Mr. Holman stated that he though it was inadvisable to use lead with a rubber covered cable, inasmuch as it was an extra precaution which their experience had shown was not worthy of being paid for. In answer to a question as to the cable versus aerial lines, he said that if the conditions were favorable, the aerial line was by all means preferable.

A paper was also read by Mr. R. J. Russell, of St. Louis, Mo., on "Single Phase Motors as a Means of Increasing Station Earnings."

Amongst those noticed as being in attendance were J. F. Thorne, Pittsburg, Pa.; H. B. Kirkland, Chelsea, Mass.; J. M. Leamy, Buffalo; J. W. Pitcher, Halifax, N. S.; R. J. Russell, St. Louis, Mo.; F. G. Bolles, Cincinnati, O.; G. A. Patterson, Brandon, Manitoba; A. Warren, New York City; P. H. Hover, New York City; A. P. Manning, New York City; C. F. Scott, Pittsburg, Pa.; Dr. R. B. Owen, McGill University, Montreal, together with representatives of the various companies in the many towns and cities in Canada.

The Canadian Bullock Electric Manufacturing Company of Montreal presented each person in attendance with a white button containing a number, and each day issued a neat booklet containing a list of those in attendance with a number opposite each name corresponding with the numbers on the buttons, which provided a means of identification for the members and their friends.

The social features of the Convention consisted of a tally-ho drive to points of interest in the city by courtesy of the Canadian General Electric Company; an excursion by special steamer and band concert at Toronto Island; a visit by special cars to the works of the Canada Foundry Company, by courtesy of the company, and the annual Association dinner.

Invitations were also extended by the De Forest Wireless Telegraph Company of Canada to inspect their station where messages were continually being sent to and received from Hamilton, a distance of forty miles; also by the Metropolitan Electric Railway.

In connection with the Question Box some of the questions asked and answers given were as follows: Question: Is it advisable to "ground" secondaries at the transformer or in the building supplied? Answer: At the transformer.

Answer (No. 2): To ground secondaries at the transformer would seem to be the more preferable method. It would ensure all consumers lines being protected; whereas grounding in the building would often be found inconvenient and too often would be neglected altogether.

Question: Should meters be tested in place or should they be returned to the station for that purpose?

Ans.: (1) In some cases in place, in others taken to the station.

Ans.: (2) Government regulations require that meters should be presented to the Inspector for inspection. To test *in situ* is extremely inconvenient and sometimes impossible. An extra fee is charged for meters so tested.

Question: What has been the experience of water power plants with the maximum demand flat rate, controlled by a Lacey controller, or similar device?

Ans.: (1) Systematic inspection, while not having been shown to be absolutely necessary so far, would seem to us to be very advisable and a convenient method of testing controllers in places desirable.

Ans.: (2) An experience of about six months with the Lacey controller would indicate that it furnishes the best means so far put on the market to deal with flat rates. Common sense would dictate that this instrument, the same as any other device for measuring current, should not be allowed to go for an indefinite time without inspection and test. A testing box equipped with standard lamps or some other suitable load, with an indicating wattmeter or an ammeter and voltmeter attached, and a connecting device which would admit of the outfit being quickly attached to the circuit near the controller would probably fill the bill. In setting the controller, it must be adjusted to carry the load contracted for at the extreme voltage which the circuit is subjected to, otherwise the controller will trip when the voltage rises, without having more than the rated number of lamps in circuit.

Ans.: (3) The maximum demand rate by a Lacey controller suits quite a large class of customers, knowing the amount payable each month regardless of the hours burning. The contractor has the benefit of the load to put on a transformer; no meter readings and fewer inspections.

On Friday morning the officers and members of the various committees were elected for the ensuing year and resulted as follows: Mr. J. J. Wright (Toronto), President; J. B. Thornton (Montreal), 1st Vice-President; A. A. Wright, M. P. (Renfrew), 2d Vice-President; C. H. Mortimer (Toronto), Secretary-Treasurer.

Executive Committee: Messrs. John Yule, A. B. Smith, P. G. Gossler, A. A. Dion, Gordon Henderson, B. F. Reesor, C. K. Greene, C. B. Hunt, J. A. Kammerer and H. O. Fiske.

Committee on Statistics: Messrs. A. A. Wright, D. R. Street and J. W. Purcell.

Committee to confer with Underwriters: Messrs. P. G. Gossler, A. A. Dion, J. J. Wright, G. U. G. Holman and Mr. Wight.

Committee on Legislation (Ontario): Messrs. Hunt, A. A. Wright, Reesor, Dion, Breithaupt, McCullouch, J. J. Wright and J. W. Purcell, with power to add to their numbers.

(Quebec): Messrs. E. A. Evans, J. McCarthy, P. G. Gossler, Sangster and Holman, with power to add to their numbers, the first named in each case to be the convenor.

After considerable discussion as to the respective claims of Hamilton and Montreal as the place for holding the next Convention, on a vote having been taken, Hamilton was selected.

On the recommendation of the Committee on a standard system of accounting for electric lighting companies and on motion of Mr. A. A. Dion, seconded by Mr. A. Williams, the report of the Committee on standardization of accounts made to the last annual meeting of the Association, was received and adopted, and the standard system of accounts for Electric Lighting Companies recommended for adoption by the National Electric Light Association of the United States, was recommended by this Committee for adoption by the Canadian Electrical Association.

On motion of Mr. C. B. Hunt, the Association approved of the appointment of a Question Box editor, the appointment being left in the hands of the Executive Committee, an appropriation to be made from the Nicholls Fund to be made towards paying for prizes to be given for the best answers to questions submitted, and to defray the necessary expenses in connection with this department.

After some further discussion and the passing of votes of thanks to those who had contributed to the success of the Convention, the meeting adjourned to meet in Hamilton, Ont., in 1904.

The Chicago Independent Telephone Convention.

It is hoped and believed that the annual meeting in Chicago next week, at the Auditorium Hotel, of the Independent Telephone Association of the United States, will be of unusual interest, and will secure a large attendance. Mr. J. G. Ihmsen is chairman of the local committee in Chicago which has been putting in a lot of hard work.

The programme as announced by Mr. J. B. Ware, the secretary, is as follows: June 24, 2 P. M.—Address of welcome by Hon. Carter H. Harrison, Mayor of Chicago; response by Hon. S. P. Sheerin, of Indianapolis, Ind.; annual address of President James M. Thomas; roll call of States, ten-minute reports; "Advantages of Association," by Hon. C. E. Hull, of Salem, Ill., president Interstate Telephone Association; "The Telephone and the Technical School," J. C. Kelsey, professor of telephony, Purdue University, Lafayette, Ind.; "Modern Exchange Construction," W. H. Johnson, general superintendent Frontier Telephone Company, Buffalo, N. Y.; "Independent Telephone Development in the South," by C. E. Stinson, president Memphis Telephone Company, Memphis, Tenn.; "Western Telephone Development," J. S. Bellamy, Knoxville, Iowa. 6 P. M., concert in Auditorium Hotel. 8 P. M., special train to San Souci Park; programme of entertainment there to be given later. June 25, 10 A. M.—Patent Litigation Committee report, Hon. Hugh Dougherty, of Bluffton, Ind., chairman; "Telephone Discipline," by C. E. Tarte, general manager Citizens' Telephone Company, Grand Rapids, Mich.; "Eastern Telephone Development," F. A. Demarest, general superintendent Interstate Telephone nd Telegraph Company, Trenton, N. J.; "Present and Future," Frank L. Beam, Columbus, Ohio; General business; election of officers.

Note on Artificial Fluorescence of Living Human Tissue.

By William James Morton, M. D.

If a solution of bisulphate of quinine or of the alkaloid quinine, of the strength of one grain to eight ounces, contained in an ordinary glass bottle, is subjected to x-radiation in the dark, these solutions will be seen to glow with the fine, opalescent violet ray fluorescence of quinine solutions.

Calculating the amount of blood in a human body to be one-thirteenth part in weight of the entire body, we may estimate that a person weighing 130 pounds will contain ten pounds of blood. This is equivalent to ten pints or equivalent to the above given ratio of one grain to eight ounces of water. We may, therefore, without doubt, conclude that the fluids of a person to whom twenty grains of quinine has been administered represent a solution of quinine equivalent to that mentioned in the bottles; and equally when such a person is exposed to the x-ray, that the person's tissue will be rendered fluorescent in the same manner.

The quinine may be administered about one hour before the x-ray treatment and in a dosage of from five to twenty grains.

It is recognized that the radiations of substances exhibiting a violet color possess curative properties in disease. We have thus presented to us by this new procedure, a method of producing fluorescence in more intimate relation to the tissue elements than can be gained by any method from the exterior. In this manner I have been treating cancer now for over a year, and with, I believe, results which could not be attained by the x-ray alone, though this is purely a clinical deduction. I have also treated cases of pseudo-leukæmia, chronic malaria, and many other diseases, not necessary here to mention, in this manner. It is only desired in this communication to present briefly the method and the possibilities of this new form of application of fluorescent radiations.

Among other fluorescent liquids, some of which may be used medically, Mr. W. J. Hammer, in a recent publication, enumerates the following: Petroleum, quinine, Magdala red, eosine, uranine, saffronine, paviine, æsculine, amidophthalic acid, fluorescine, rhodamin, thalleen, resorcorufin, and resorcin blue.

Western Union Earnings.

The Western Union Telegraph Company issues the following statement for the quarter ended June 30, 1903, the figures for the current year being partly estimated, while those for 1902 are actual:

	1903.	1902.	Changes.
Net revenue	$2,000,000	$1,892,476	Inc. $107,524
Bond interest	286,300	254,770	Inc. 31,530
Balance	$1,713,700	$1,637,706	Inc. $75,994
Dividends	$1,217,014	$1,217,009	Inc. $5
Surplus	$496,686	$420,697	Inc. $75,989
Previous surplus	$12,515,341	$10,330,306	Inc. $2,185,035
Total surplus	$13,012,027	$10,751,003	Inc. $2,261,024

The above statement, partly estimated, yields the approximate figures for the twelve months ending June 30, 1903 as follows:

	1903.	1902.	Changes.
Net revenue	$8,206,773	$7,292,328	Inc. $914,445
Bond interest	1,077,700	992,580	Inc. 85,120
Balance	$7,129,073	$6,299,748	Inc. $829,325
Dividends	4,868,050	4,868,031	Inc. 19
Surplus	$2,261,023	$1,431,717	Inc. $829,306
Previous surplus	10,751,003	9,319,286	Inc. 1,431,717

The actual returns for the March 31, 1903, quarter were: Net revenue, $1,842,269; bond interest, $286,300; balance, $1,555,969; dividends, $1,217,014; surplus, $338,955; previous surplus, $12,176,386. Total surplus, $12,515,341.

Telephone War in Sweden.

Great public inconvenience has, according to a despatch from Stockholm, Sweden, resulted from the war between the Swedish state telephone system and the Stockholm private telephone company. The private company's wires are confined to the city and its suburbs. The government having broken off communication between the two systems, patrons of the private company cannot talk with the provinces where the State system is in control. The alleged cause of the trouble between the two interests, as presented by the government authorities, is the arbitrary methods pursued by the private company, which are stated to be inimical to the interests of people of all classes who use the telephone. Possibly it is the other way around.

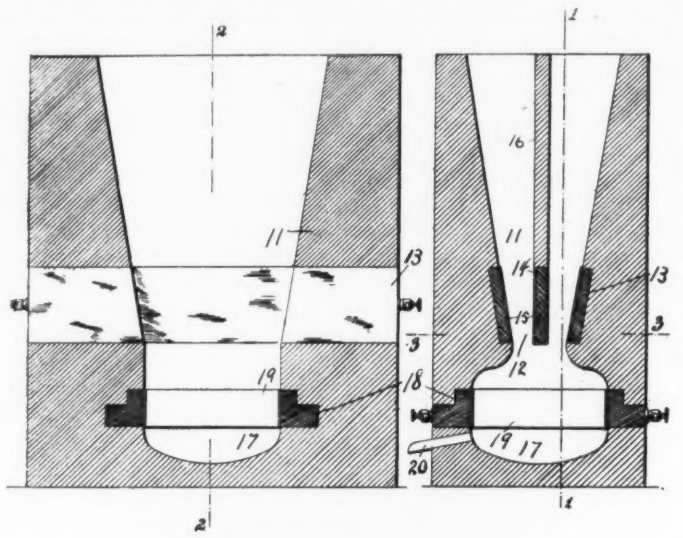
Recent Electrochemical Developments.

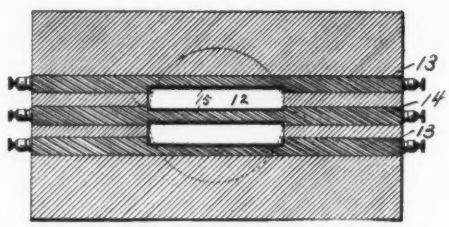
BY CLINTON PAUL TOWSEND.

REDUCTION OF IRON ORES.

The accompanying cuts illustrate in vertical and horizontal section a form of electric resistance furnace recently patented to Michael R. Conley, and assigned to the Electric Furnace Company, of New York. Mr. Conley's purpose here as in the constructions heretofore described is the reduction of iron ores and the direct production therefrom of steel; to this end the furnace is fitted with two sets of superposed resistance bands, of which the upper accomplishes the reduction of the ore, and the lower maintains the metal at such temperature as will permit it to be run or cast direct from the furnace.

The furnace comprises a fire-clay or fire-brick stack 11, the shaft of which converges downwardly to a neck 12, below which is an enlarged hearth 17 for the reception of the metal. Within the neck of the furnace and protected from the weight of the charge by embedding in the furnace walls, are two resistance pieces 13, composed of graphite and fire-clay in proportion to one to three. A central resistance plate 14 of similar composition extends across the furnace





SECTIONS OF ELECTRIC FURNACE.

midway between the plates 13, and is protected from the superincumbent charge by a fire-brick partition 16. All of these plates are reduced in cross section in their central portions in order to increase the heat development, and are protected from the oxidizing influence of the ore by a coating of magnesite 15. Midway of the hearth, and encompassing it, is the lower resistance band 18, sheathed by a magnesite coating 19. The taphole 20 is situated below this band.

The advantages of the electric furnace for the particular purpose in view are the application of the heat to the interior of the charge, the close regulation of the temperature to the necessities of the reaction, and the fact that the reduced metal comes into contact with no carbon surfaces other than the carbon mixed with the charge and that this carbon can therefore, in theory at least, be accurately gauged to reduce the ore and carburize the metal to the extent desired. A further advantage claimed is the feasibility of the reduction of fine oxids and concentrates without previous briquetting.

Boston Edison Company Hearing.

Considerable information of interest in regard to the business of the Edison Electric Illuminating Company of Boston was brought out on June 9 at a hearing held before the Massachusetts Gas & Electric Light Commission, on the question of issuing 20,000 new shares of stock, amounting to $4,000,000, to pay for the various suburban electric light companies which have recently been acquired, new plant, cables, tubes, etc. President C. L. Edgar submitted a large number of detailed figures in regard to the proposed expenditure.

These showed in brief that on December 31, 1902, the company had notes payable amounting to $683,000, and that appropriations for the year amounted to $97,000, making a gross debt of $780,000. Deducting $384,000, the balance due on capital stock left a net debt of $396,000 at the beginning of 1903. This balance on capital stock is to be paid in August. The 1903 budget of the company, as settled upon by the officers, amounts to $2,510,000, with an additional 5 per cent. for contingencies, a total of $2,635,000. Of this amount the largest item is for the new L street station in South Boston, which is now under construction; and it is hoped that it will be completed by December 1 of the present year. The station is to have 4 units instead of 3, and will cost, exclusive of the coal plant on the harbor, $1,347,000. The estimated cost of the coal plant is $103,000. The expense for tubes and cables this year is set at about $329,000.

The suburban electric light companies which have been acquired and the cost of each are the Milton Light & Power Company, $71,000; Dedham Electric Company, $135,000; Blue Hill Electric Company, $76,000; Natick Gas & Electric Company, $188,000; Framingham Electric Company, $134,000; Woburn Light, Heat & Power Company, $269,000; Somerville Electric Light Company, $627,000; Needham Company, $30,000; Chelsea Gas Light Company, $287,000, and Newton and Watertown Electric Company, $412,000, a total expenditure of $2,229,000. All but the Chelsea and Newton companies have been purchased, and options are to be taken up on these last two.

The total stock of the companies to be cancelled by the Edison Company, when it gets the new stock asked for, is $723,000; total bonds, $239,000, and total debts outside, $280,000; in coupon bonds, etc., $330,000; a total of $1,292,000. For this amount the Edison Company is to devote the proceeds of its sale of stock to the extent of $1,500,000. A part of the premium received will be used towards paying for the Chelsea and the Newton Companies.

The net debt of December 31, 1902, the 1903 budget and the cost of securing the outside companies amount to $5,260,000. Of this amount, $300,000 in undivided profits is to be deducted, and also $1,730,000 of capital stock that has been authorized, but not issued, leaving a debt of $3,230,000. Expenditures for 1904 are estimated at $1,610,000, covering the cost of lamps, service meters, a new unit in the power station and general extensions. These include possible new sub-stations or extensions in the north and west ends, and in Roxbury. The estimated debt on December 31, 1904, is thus $4,490,000. Of this amount the company wishes to fund $4,000,000 in the additional stock asked for at the present time.

The debt of the Edison Company is largely held by corporations and individuals. The amounts required for the purchase of the suburban companies were fixed by the selling price of the stockholders. The Massachusetts Gas Companies are to take the gas business of the Newton Company. The Edison Company intends to run the electric plant at Chelsea and supply Chelsea and Somerville. It will close practically all the stations to the south and west of Boston and supply the districts from that city. The system of contracts in use in Boston will eventually be adopted throughout the system. One advantage of the consolidation will be the supplying of 24-hour service to all the cities, a privilege which they do not all possess at present. There was no opposition at the hearing.

Philadelphia Meeting A. I. E. E.

The fourth regular meeting of the Philadelphia Branch of the American Institute of Electrical Engineers was held Monday day evening, June 8. The meeting was very well attended, there being over three hundred visitors and members present. Mr. William J. Hammer gave his lecture on "Radium and other Radio-active Substances," which was freely illustrated by experiments and lantern slides. Mr. Joseph Menchen, of New York, through his representative, Mr. Eckhardt, gave some examples of the way in which electricity is made use of on the stage. He showed various scenic effects, the one which pleased the meeting most being a combination of the rising moon playing upon dashing waters, showing the reflection of the moonlight on the water ripples, while the wind is driving clouds across the sky. He also showed waterfalls, snow storms, and sand storms. His apparatus was inspected by the members with much interest after the meeting. This was the last meeting of the Branch for this season. The next meeting will be held in September.

New Telephone Patents.

"LOADING" TELEPHONE LINES.

Attention is again called to loading of telephone lines by a patent issued to H. S. Warren and G. A. Campbell for what may be termed a "terminal taper," in contradistinction to the "terminal transformer." With any wave motion it is universal experience that when there is an abrupt change in the character of this medium through which that wave is progressing, a reflection more or less complete takes place at the point of contact of the two dissimilar media. This is clearly recognized in the reflection of light at the surface of water, or the echo or reflection of sound from a solid body. So is it with electric wave motions progressing in conducting media such as a line circuit. If such a circuit be composed of a series of sections,

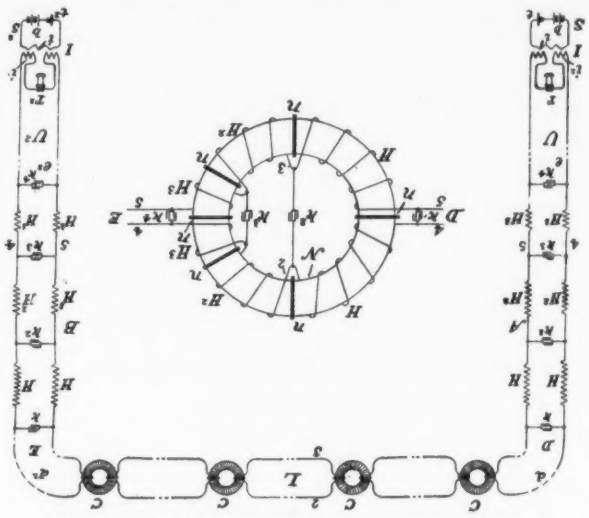


FIG. 1.—WARREN AND CAMPBELL LOADED CIRCUIT.

adjacent sections being of widely different electrical characteristics, that is, having combinations of resistance, inductance and capacity such that their resultant effect in the different sections is markedly different, then a very considerable reflection will take place at each change point. With loaded telephone working where long toll lines only are loaded with inserted series of impedance coils, if a local unloaded subscriber's loop or local trunk line, with its low inductance, be connected as an extension, the reflection loss at the junction of the toll and local lines becomes prohibitive. The terminal transformer was the first suggestion to overcome this difficulty, the primary and secondary windings being suitably proportioned, respectively, to the unloaded and loaded circuits. Such a transformer is not, however, a practical success, as it divides the circuits into two distinct conductive parts, and therefore prohibits the use of through lines for direct currents; for example, their use for a composite or simultaneous telegraphic and telephonic communication. Furthermore, it has been found difficult to design a transformer which will not introduce losses of a magnitude comparable with the reflection losses to be overcome.

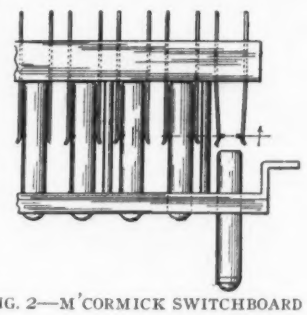


FIG. 2—M'CORMICK SWITCHBOARD

The terminal taper, which to all intents is a series of auto-transformers, serves to not only maintain the conductive continuity of the wires, but at the same time to avoid reflection losses. This device is represented in Fig. 1 by the windings H, H^2, H^3. C C C are the loading coils of the main toll line, while I, I, are the telephone instruments at the ends of the unloaded local circuits U, U^2. The two coils H, H are balanced, as also are H^2, H^2 and H^3, H^3 and these series of coils are so proportioned as to number of turns

and resistance, that taken with the capacity of the condensers K, K^2, etc., bridged between them a gradual tapering of the impedance of the circuit takes place in passing through them. Thus, the H, H part of the circuit is relatively like that of the loaded portion of the line in characteristic, while the H^3, H^3 end is similar to the unloaded end, a sufficient number of intermediate steps being used to reduce the individual reflections to a point such that their sum is practically small. Messrs. Warren and Campbell have assigned their patent to the Bell Company, the holder of the fundamental loading patents.

LAMP JACK.

Mr. W. E. McCormick, of Chicago, has patented a new lamp jack and assigned his patent to the International Telephone Manufacturing Company. This lamp jack, shown in Fig. 2, is a sort of companion piece to the same inventor's strip jack patented some time ago. As will be seen, all strain is thrown directly on the front supporting strip, the lamp jack being in skeleton form. An insulating fibrous sleeve surrounds the lamp, guides it into position and isolates its illumination to its own bull's-eye. It will be interesting to know just what fiber will be selected, for experience has shown such material in the thin sheet necessary for this work, to warp almost out off recognition in the immediate presence of a source of heat, and hard rubber has been found to be nearly as bad.

A ONE-WIRE CENTRAL ENERGY BOARD.

A third telephone patent is that for a one-wire central energy switchboard. We have all seen the three-wire switchboard of the Western Electric Company, followed by the two-wire switchboard

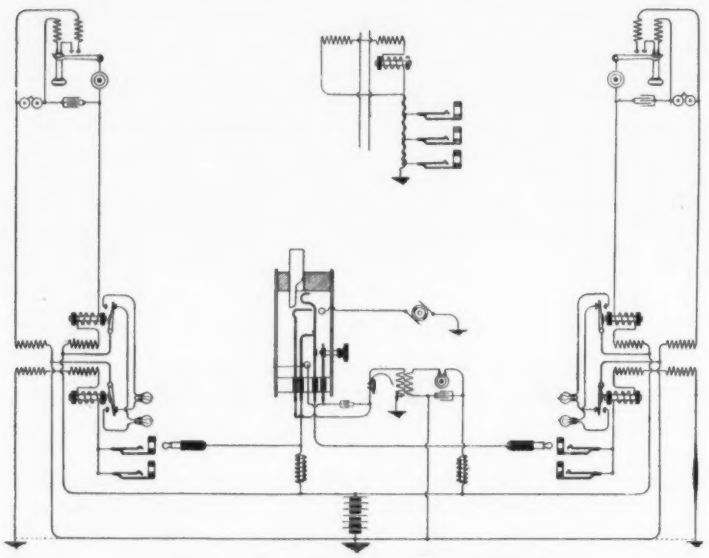


FIG. 3.—O'CONNELL EXCHANGE SYSTEM.

of the Kellogg Company. Now the Western Electric Company tries to go one better in the production of this switchboard, the patent for which is granted to J. J. O'Connell and assigned to them. As will be noted from Fig. 3, which shows the general circuit together with a sketch of how it is proposed to avoid cross-talk, the connecting cords form a local grounded or common return system, only connected with the subscriber's line system by the agency of repeating coils. It will thus be understood that each subscriber's line must contain primarily such a repeating coil. One side of this coil serves to send battery to the subscriber's line and repeat the voice currents to the other side of the coil, which is connected between the jack and ground. All that it is necessary therefore to complete the talking connection is to provide a single conductor between the spring jacks of the two lines in question. This simplicity of cord circuit banishes the supervisory lamp from the cord circuit, and this lamp has therefore been associated with the answering jack, one for each subscriber, and has been colored red to be distinguishable from the line lamp. Thus red lamps will flash at various points of the switchboard, which will have no significance, as the disconnection can only be made by the operator of the calling party. The system is therefore a one-light supervision system with the added precaution of an indication of "hang-ups" at a portion of the switchboard other than that where the "hang-up" exists. The exact operation of the signals and the combined ringing and listening key is easily traceable and need not therefore be further discussed.

Independent Telephony in New York State.

It would appear from the meeting held in Utica on June 10, that the differences existing in the independent telephone field in New York State have been adjusted so that the New York State Independent Telephone Association may be said to represent the interests characterized by its title. The meeting was called to order by President George R. Fuller, of Rochester, N. Y., who discussed the conditions under which the meeting was held and named the various points in the State at which Independent exchanges had been established. With regard to membership in the Association, he proposed certain changes based on $2 for the first 100 telephones and $1 for each additional 100 telephones up to 500. From 500 up to 1,000, 50 cents for each additional 100. Above 1,000, 25 cents for each 100, extra assessments for any one year being limited to 25 per cent. of the annual dues. He also proposed liberal treatment of the supply trade.

Mr. C. O. Harris read a paper on the Growth of Independent Telephony in the State of New York, and Mr. Potter, of Syracuse, read a paper on Uniformity in Telephone Service.

Officers for the ensuing year were elected as follows: President, George R. Fuller, of Rochester; first vice-president, Howard Hendrickson, of Albany; second vice-president, J. H. Scofield, of New York City; secretary and treasurer, J. B. Ware, of Buffalo. Executive Committee: H. H. Persons, of Buffalo; B. G. Hubbell, of Buffalo; S. B. Rawson, of Niagara Falls; Edward Davis, of Binghamton; T. H. Ferris, of Utica; J. S. G. Edwards, of Gloversville; J. S. Brailey, Jr., of Herkimer, and T. S. Lane, of Jamestown. Inspectors: C. H. Poole, of Utica, and C. O. Harris, of Rochester.

During the evening a reception was held at the Home Telephone Company's Exchange of Utica, the equipment of which was installed by the Stromberg-Carlson Company, including a 10-section central energy board.

Among the manufacturing interests represented at the Convention were the Sterling Electric Company, Lafayette, Ind.; Kellogg Switchboard and Supply Company; American Electric Telephone Company; North Electric Company; American Novelty and Manufacturing Company, New York City, and the Stromberg-Carlson Telephone Company.

Annual Meeting of the New York Electrical Society.

The annual meeting of the New York Electrical Society for the election of officers was held at the Café Boulevard, New York City, June 10. The officers elected were: President, J. J. Carty; Vice-Presidents, W. I. Donshea, Hobart D. Betts, W. S. Barstow, Douglass Burnett, H. C. Townsend, F. C. Bates; Secretary, George H. Guy; Treasurer, Henry A. Sinclair. The reports of the secretary and treasurer showed the society to be in a more flourishing condition than ever. One hundred and eighty-six members were elected during the year; there were 26 resignations and 3 deaths, and 51 were struck off the rolls for non-payment of dues. The net gain in membership is 106, the present membership numbering 619. The quality of the papers presented at the season's meeting, a matter of supreme importance in this organization, has been fully up to the exacting standard of late years, and there is a feeling of confidence among the members that the society is pressing on at a sure and steady gait towards the 1,000-member mark. An excellent dinner was served and a carefully selected musical programme was rendered by the Hungarian Band. The vocal part of the evening's entertainment was provided by Mr. Charles Stuart Phillips, whose rich and powerful tenor voice rang out to fine advantage in several beautiful compositions.

Trolley New York to Boston.

At New Haven, Conn., on June 16, in the Superior Court, Judge William T. Elmer granted permission for the construction of the last link of trolley line necessary for a complete electric road between New York and Boston, paralleling the New York and New Haven from the Hub to the Grand Central Station. The new road, upon which work will be begun at once, will connect New Haven with Wallingford and is about six miles long.

CURRENT NEWS AND NOTES.

UTILITY OF TELEPHONE.—The New York and New Jersey Telephone Company has just removed the telephones from all suburban public schools and municipal courts because of the failure of the fusion administration to pay tolls for the last two years. By the use of the telephone much time was saved by both the courts and the lawyers, cases being called to suit the convenience of both sides and promptly disposed of. In the public schools the telephone was used by the principals to summon substitute teachers and to report to the board rooms, saving many hours to the scholars in cases where teachers failed to report and enabling the principals to remain at their posts.

PROPOSED PATENT LAWS IN MEXICO.—Under date of May 16, 1903, Consul W. W. Canada, of Vera Cruz, says: "A bill has been laid before the Congress of Mexico providing that trade-marks shall be registered and patents for inventions granted without previous investigations respecting their novelty or originality. Petitions for registrations of trade-marks and applications for patent rights are to receive prompt attention, and measures shall be taken to effect a reduction in the charges made for such service. A special code of penal laws for the prevention of fraudulent uses of trade-marks, etc., and violation of patent rights is to be prepared. The law to be enacted shall be in accordance with the convention of Paris, March 20, 1883, that there may be no impediment to Mexico joining the International Union for the Protection of Industrial Rights."

ELECTRICITY IN SURGERY.—Surgery without the use of ligatures was advocated in Europe recently by Dr. Andrew J. Downes, of Philadelphia, who has just returned from Madrid, whither he went to attend the International Medical Congress. Dr. Downes read a paper on "Electro-Thermic Hacmostasis in Abdominal Surgery." Practical demonstrations of this method of performing surgical operations without employing ligatures were given by Dr. Downes at clinics in several cities in Europe. In all surgical operations, as usually performed, hemorrhage is controlled by the use of ligatures. The new method consist of the use of various sized pressure forceps, of special design, in the blades of which is an insulated piece of platinum, which is heated by the passage of a suitable electrical current through it. It cooks the tissue under pressure, obliterating its blood vessels. The process is an absolutely aseptic one.

CUTTING WESTERN UNION WIRES.—At Philadelphia, on June 11, in a decree by Judge Acheson in the United States Circuit Court of Appeals, the order of the Circuit Court of New Jersey, on January 21 last, directing that the Pennsylvania Railroad and the United New Jersey Railroad and Canal Company be restrained from in any manner interfering with the use and operation of the telegraph lines of the Western Union Telegraph Company until the right of way dispute is finally decided by the Supreme Court of the United States, was reversed. This decree practically declares that the demolition of the telegraph company's poles and wires by the railroad company was justified legally and is a flat refusal by the court of the order for stay of proceedings petitioned for recently by counsel for the telegraph company. Should any poles or wires still remain untouched they may now be torn down. The Appellate Court's decree covers less than one-half of a typewritten page, and sets forth no grounds for the reversal of the lower court's injunction.

CHEMICAL ELECTRIC SIGN.—A patent was granted on June 9 to Mr. Harry B. Wren, of Washington, D. C., for an electric sign. It is composed of parts of suitable form made of a conducing material and embedded in a foundation of non-conducting material; they are connected in a suitable manner by wires to the electric supply circuit. The principal point of the invention is that these conducting elements are covered or permeated with a chemical compound which changes color with change of temperature or other change of state. The following prescription is given for such a compound: mix one part of powdered cobalt and four parts of aqua regia, add one part of sodium chloride and sixteen parts of water, filter and mix with gum to the consistency of paint. When the electric current is turned on, the temperature of the conducting elements changes and the outline of the design appears in a color different from that at normal temperature. Similar effects may be produced by means of electromagnets, which attract metallic filings of various colors and produce the outline of the letter or character desired.

THE UNION ENGINEERING BUILDING.—At the meeting at Asheville, N. C., last week of the American Society of Civil Engineers, action was taken in regard to the participation of the Society in the million-dollar building presented lately by Mr. Andrew Carnegie to such of the national bodies as wished to share in it, and the Engineers' Club, of New York City. It resolved that the Board of Direction be authorized to ascertain whether suitable accommodations can be obtained for the Society in the proposed new building, with provisions for future needs, and also to make such investigations and hold such conferences as may be necessary on the advisability of the acceptance of Mr. Carnegie's gift by the Society. It was also resolved that the Board of Direction be authorized to co-operate to this end with the other organizations concerned, and that it be requested, provided it is satisfied that suitable accommodations can be obtained and that acceptance of the gift is otherwise practicable, to send members of the Society a letter ballot, by means of which direct expression of the wishes of the Society in the matter may be secured, and to accompany such ballot by statement of the reasons for and against uniting in the scheme with the other organizations. It was resolved that the Board of Direction, in case a majority of the members, as shown by the letter ballot, are in favor of uniting with the other organizations, is authorized to proceed in behalf of the Society in carrying out the project. It was also voted that the letter ballot provided in the foregoing resolution should be presented to the Society with the usual sixty days' notice, and an opportunity for discussion at the next annual meeting. The Boston chapter has recently voted overwhelmingly in favor of accepting Mr. Carnegie's generous offer.

MAGNETIC SUSPENSION FOR INSTRUMENTS.—Two patents for magnetic suspension devices were granted on June 9, the one to Mr. Frank P. Cox, of Lynn, Mass., the other to Mr. William H. Pratt, of Lynn, Mass., both assigned to the General Electric Company. Mr. Cox annuls or diminished the mechanical friction due to the weight of the shaft of an electric meter in the following way: The shaft is held in position by two bearing rings at the upper and lower ends and the magnetic suspension device is placed at its upper end. It consist of an iron body of, a form which may perhaps be best described by assuming an being revolved around its middle axle which is in direction of the shaft; it consists, therefore, of an outside ring and an axle in the center, the ring being closed by a circular iron plate at the top, and polar projections being provided at the bottom; the magnetising coil is wound around the axle in the center. In this way a strong magnetic flux is produced, the lines of force being radial and horizontal. In the annular space through which the flux passes, an annular mass of soft iron is placed so as to nearly fill this space, small air-gaps only being left. This iron ring is supported on a number of arms of non-magnetic material, connected to the upper end of the shaft of the instrument. The magnetic flux holds the iron ring in such a position that the weight of the shaft and armature is supported wholly independent of any mechanical bearings. The patent, granted to Mr. William H. Pratt, is for a similar arrangement; the magnet is also assumed to have one of its poles annularly shaped and surrounding the other; the flux passes between the poles in horizontal radial lines, and in this space the annular armature is placed which bears the shaft of the instrument. So far the arrangement is exactly the same as in the above patent of Mr. Cox. But Mr. Pratt points out that this arrangement in general has the disadvantages that if the annular armature has a comparatively small circumferential reluctance, whenever it is displaced sidewise there is a tendency for the flux, or part of it, to enter the armature at one side, flow half-way around the armature, and go out at the other side. This flux then tends to hold the armature permanently displaced. To reduce this tendency, Mr. Pratt arranges the magnetic circuit of the armature in such a manner as to oppose but little reluctance to the passage of a radial flux, and considerable reluctance to the passage of a circumferential flux. This is accomplished by the use of an armature formed of blocks of magnetic material separated by air-gaps. He thus overcomes the tendency to hold the armature permanently displaced when once accidentally displaced.

FIRE IN A NIAGARA PLANT.—According to a press dispatch, a fire in the works of the old Bury Chemical Works, at Niagara Falls, destroyed ten transformers and six rotary converters a few days ago. The damage is given as $100,000. The works are located on the lands of the Niagara Power Company and produce yellow phosphorus and potassium chlorate.

RADIUM AND EYESIGHT.—A cable dispatch from Berlin, Germany, of June 7, says: "Dr. Lunden, a German scientist, says he has proved by experiments that rays reflected from radium enable the blind to see more or less clearly. He instances the cases of two Russian blind boys who permanently regained their sight through the use of these rays."

MUNICIPAL ELECTRICIANS.—The Eighth Annual Convention of the International Association of Municipal Electricians will be held in the banquet hall of the Hotel Rudolf, Atlantic City, N. J., Wednesday, Thursday and Friday, September 2, 3 and 4, 1903. The following rates have been secured from the hotel: $3 each, one or two persons in one room; $2.50 each, three or four persons in one room and two beds; with bath, $4.50 one person and $7.50 for two persons. Those desiring rooms should write to Mr. William Cochran, manager, Hotel Rudolf. The following papers have been promised: "The Best Methods for Lighting Small Cities," "Classifying of Records of Electrical Departments, and Standard Specifications for Supplies and Contracts," "Importance of the Fire and Police Telegraph Systems." There will also be a "topical discussion" of Line Construction, which is expected to bring out all the different ideas of the several members in relation to this important question. An exhibit will also be made of apparatus.

WESTINGHOUSE IN CANADA.—For some years past the Westinghouse people have had air-brake works at Hamilton. It is now proposed to amalgamate the Canadian air-brake business with that of a new Canadian Westinghouse Electric Company. A meeting of the organization committee was held recently at Hamilton when the following gentlemen were present: Mr. H. H. Westinghouse, vice-president of the Westinghouse Air-Brake Company of Pittsburg; Mr. J. F. Miller, secretary of the same company; Mr. L. A. Osborne, fourth vice-president of the Westinghouse Electric and Manufacturing Company of Pittsburg; Mr. Warren Y. Soper, of Ottawa, and Mr. Paul J. Myles, of Hamilton. It is understood that a number of influential Canadians will be financially interested in the new undertaking. The importance of this addition to Canadian industry cannot be overestimated. The business in Canada of late years has grown to such proportions that it warrants the establishment of a domestic factory to be devoted to the demands and interests of the Dominion. The capital will be $2,500,000.

WIRELESS AT SEA.—A new application of wireless telegraphy is noted by the captain of the *Kaiser Wilhelm II* of the North German Lloyd Steamship Company. On a recent voyage across the Atlantic to New York he had been unable to obtain an observation throughout the entire voyage, but approaching the British Isles he became convinced that he was nearing land and was unable to ascertain his exact location. He directed the Marconi operator to send out a message, and received a response from the Crookhaven station. This did not betray the location of the ship to the captain any more definitely than his dead reckoning had done. A second message was sent to the Crookhaven station, requesting that a sharp lookout be kept, and that when the fog whistle was first heard a dispatch be immediately sent to the ship notifying them to that effect. Several hours later a message was received on board the vessel saying: "We have just distinguished your fog whistle." Crookhaven was then requested to sound its fog signal at stated intervals, and by this means the *Kaiser Wilhelm* was able to definitely ascertain its location. On the return voyage, the same ship, when 350 miles out from Nantucket light, reported her approach to this coast by means of relaying from the steamship *Minnehaha*, which was 150 miles nearer the lightship than the German vessel. It was thus enabled to report its arrival twelve hours earlier than it would otherwise have been able to do.

REPEATING BREAK FOR ELECTRIC CIRCUITS.—A patent was granted on June 9 to Mr. Leo Daft, of Ealing, the electric railway pioneer, and Mr. Alfred Williams, of Wimbledon, England, for a repeating break for electric circuits. The chief advantages of this break are said to be that the frequency can within wide limits be regulated to any desired degree; the fraction of the period during which contact occurs before break can be regulated; the rapidity of the severance of the surface at the desired moment is a maximum. The two surfaces when in contact are caused to move relatively to one another; this has the effect of displacing any impurities between the surfaces and allows them to come into more intimate contact. The points of the two surfaces which mutually part company when the break occurs are changed in each successive break, so that the condition of the surfaces is rendered more permanent on account of the distribution of the unavoidable wear and tear, due to sparking over the whole area of contact uniformly. An electric motor drives the break, and a rheostat is used for regulating the speed. Several forms of the apparatus are described. In one form the surfaces of contact are two parallel concentric circular plane areas. One is caused to turn in its plane about its center through a small angle in each contact, the other not rotating. The contact surfaces are of platinum and immersed in a bath of non-conducting fluid, such as alcohol, petroleum, or other hydrocarbon; the fluid serves to quench the spark and the beaker collects the platinum dust so that it may be recovered. In a modification of this form of apparatus, the contact surfaces are eccentric to one another and both surfaces are caused to revolve. In another modification one of the surfaces consists of the rim of a circular disk which is caused to rotate on its axis and the other surface is concave, of the same shape as a portion of the rim of the disk. The fork which carries the revolving disk is part of a pivoted lever which is caused to make angular reciprocations. In another modification, the fork which carries the revolving disk is mounted so as to make linear reciprocations, and the other electrode is adapted to have its constant surface changed at intervals when the surface in use has become unduly worn.

VENTILATING DYNAMO ARMATURES.—The improvement of the ventilation or cooling of high speed dynamo electric machinery is of importance and recent developments tend to make it more of a consideration than ever. The means for ventilation at present employed are of two kinds. The most usual consists in forming radial gaps in the sheet-iron assemblage in such a manner that the assemblage is formed of annular blocks separated from each other by small spaces. By reason of the increase of the cooling-surface a certain improvement in the ventilation of the machine ensues; but the ventilation nevertheless remains very insufficient, the insulations of the sheet-iron opposing great difficulty to the passage of the air from one piece of sheet-iron to the other. The second process, less employed, but nevertheless more efficacious, consists in causing the air to circulate in the interior of the moving portion and around the fixed portion by means of fans directly mounted upon the shaft of the machine. In a method of ventilation just devised by Mr. A. C. E. Rateau, of Paris, France, an auxiliary fan is employed; but the system is distinguished from the prior arrangements in that the air fed by the fan is forced to circulate in inner channels formed in the fixed portion of the machine, such channels being arranged in such a manner than not only is the fixed portion cooled, but at the same time also (and this is most important) the periphery of the moving portion. In a general manner the invention consists, therefore, in forming channels through the fixed sheet-iron assemblage or in forming between them suitably arranged channels, in which air is caused to circulate by means of a fan. In this manner the air licks the face of all the sheet-iron pieces, as well as the periphery of the moving portion, quite near to where heat is evolved. The surface of contact between the air and the masses to be cooled is, on the other hand, very extended, because the channels may have a superficial area as large as desired. The channels are formed either of holes pierced by a punching-machine in the sheet-iron assemblage in the same manner that the notches for receiving the windings are formed or by gaps of suitable length formed in the succession of sheet-iron assemblages. Of course, there is left between the different channels enough metal to insure the passage of the magnetic flux. This arrangement is also applicable to machines having a rotating field the fixed portion of which is continuous and to all other electrical machines in which the poles are insulated.

ALTERNATING CURRENT MOTOR.—Mr. Alex J. Churchward, well known as an American designer of dynamo electric apparatus, has taken out a patent on a new form of alternating current motor of the self-starting type, and brought to synchronous speed. In one form he organizes the motor as a continuous or direct current motor, which, as is well known, will start and under the action of (single-phase) alternating currents fed to armature and field, will, if not too much loaded, come to synchronous speed. In its self-starting condition the motor has a field-coil in series with the armature. When brought to synchronism, a switch changes the connections, so that alternating current is fed direct to the armature by means of rings or continuous contact devices, and the field is excited by continuous current fed thereto over a circuit which is provided with regulating appliances controlled automatically in a manner to cause the field to increase in strength with the load. This continuous current may operate in any suitable coils upon the field-magnet; but when such coils are in a circuit formed as a shunt to the armature, so as to take their direct current from it, they are made as high-resistance coils and independent of those used in the non-synchronous operation.

ELECTRIC COOKING APPLIANCE.—Mr. Edward E. Gold, of New York City, who has already done a great deal of successful work in the electric heating field, has just been granted a patent on an adjustable or flexible cooking device, the application for which was made as long ago as July 16, 1896. It is based upon the use of his heating coils or spirals enclosed within the cooking chamber, associated with portable heater trays in which the coils are grouped between plates. For utilizing these electric trays or heaters Mr. Gold provides an oven or stove consisting of a casing into which the trays are inserted, so as to serve as shelves on which to place the articles to be cooked. The sides of the oven are provided with ledges or cleats for upholding the tray and so that any tray can be placed on any pair of cleats, and thereby set in the oven at any desired height. Removable grids or gratings are provided as shelves between the electric trays or upon ledges not occupied by the latter. The top of the stove is provided with stove-holes, as usual, under each of which is provided a special electric tray or heater. For introducing the electric heaters in circuit they are provided with circuit-terminals connected to the coils, adapted for connection with exterior conductors connecting with the respective circuit-leads; one or both of the connections consisting of a metallic socket in the heater connected with the coils and adapted to receive a metal pin or plug connected by a wire or cable with the stationary circuit-lead.

HIGH SPEED ELECTRIC TRAINS.—A cable dispatch from London of June 13 says: The Prussian State railways between Hamburg, Hanover and Berlin will shortly conduct an interesting competition between steam and electrically hauled trains. The leading locomotive builders and electrical firms of Germany have been invited by the State to submit designs and specifications for steam or electric locomotives or motor cars capable of making 100 miles an hour with a light load, and 90 miles an hour on ordinary traffic. The tests will be a continuation of the trials of high speed electric trains on the Prussian standard gauge military line between Berlin and Zossen, and have been arranged on account of the decision to increase the speed of trains between Hamburg, Hanover and Berlin. The *Times* expresses the opinion that even then no particular light will be shed on the question of express passenger traffic. Bearing in mind the nature of the Berlin-Zossen line, the *Times* goes on to say: "Engineers are agreed that mean speeds of over sixty to sixty-five miles an hour are practically commercially impossible on the present two-rail tracks. Owing to the existing curves and the mixture of speeds, a critical stage has been reached in railway locomotion. The liveliest interest will therefore be taken in the working of the monorail system, which is to be built between Manchester and Liverpool, on which a speed of 110 miles an hour is promised without fear of derailment. Doubtless some special form of track is the true solution of the problem of high speed."

PHASE INDICATOR.—Mr. Otto Holz, of Schenectady, has assigned to the General Electric Company a patent issued to him on a phase indicator. The instrument comprises two relatively rotatable members, one of which is charged electrostatically in accordance with the voltage of an alternating-current system and the other in accordance with the current flowing in said system. The two members are free to move relatively to each other and to assume various relative positions depending upon the phase relations between the current and electromotive force of the system, or, in other words, upon the power factor. The member responsive to potentials corresponding to current is movable and the member responsive to voltages of the alternating-current system fixed, or the reverse. In either case there will be produced in each of the members a rotating electrostatic field, so that if the two members were to be placed at random with respect to each other a torque would be exerted between the two members. The movable member being preferably free to rotate without restraint would then turn under the influence of this torque until it has assumed a position where the torque became zero. If under these conditions the currents of the alternating-current system should be in phase with the electromotive forces, this position of the movable element of the instrument would indicate unity power factor. In case the currents of the system were to shift in phase relatively to the electromotive forces the electrostatic field in the element of the power-factor indicator corresponding thereto would shift correspondingly, thereby disturbing the balance of the torques existing between the two elements of the instrument, and thereby causing the movable element to assume a new position of equilibrium corresponding to a new value of power factor. The varying values of power factor are thus indicated by the positions assumed by the movable member as an index to which a pointer movable over a scale is employed.

INDUCTION MOTOR ARMATURES.—Mr. Charles P. Steinmetz has patented an improvement in the armatures of induction motors. As is well known, these are ordinarily designed so as to have low resistance, and thus secure close speed regulation and high efficiency. When thus designed, however, the torque of the motor at starting is comparatively small and the machine therefore unsuitable for use in cases where it is required to start under load. Various expedients have been resorted to in order to secure large starting torque and at the same time to obtain high efficiency under normal load. The invention now made accomplishes this result by providing the armature or induced member with a plurality of windings, one at least of which is of the squirrel-cage type and of comparatively high resistance. At starting all of the windings of the induced member of the motor are open except the squirrel-cage winding. As soon as the motor gathers speed, however, the other winding or windings of the induced member are successively closed. The particular form of short circuiting switch is immaterial and may conveniently consist of a suitable contact-piece sliding longitudinally upon the shaft of the motor and co-operating with suitable terminals connected to the distributed winding. In starting the motor the distributed winding is open-circuited, thus rendering the same inactive, and so making use only of the squirrel-cage winding, which is usually of comparatively high resistance. After the motor has been started from rest the sections of the distributed winding are cut in one after another, thus increasing the amount of active copper in the induced member, and consequently increasing the ampere-turns, and so approaching the conditions of high efficiency and close speed regulation. When all of the windings have been cut into circuit and all of the copper on the armature becomes active in carrying current, the result secured is equivalent to that which would be obtained by the use of a single winding having the same amount of copper in cross-section, and if the amount of copper employed is sufficient the desired regulation and efficiency may be secured.

LETTER TO THE EDITORS.

Absolute Measurements in Electricity.

To the Editors of Electrical World and Engineer:

Sirs.—We are not at all responsible for the telegraphic despatches that have been sent out regarding what we are doing in my laboratory at the University of Michigan in absolute measurements in electricity. The facts are these: Two papers have already been published in the *Physical Review* in which we described an absolute electro-dynamometer of our own design and construction. The first one was by Professors Patterson and Guthe on "A Redetermination of the Electrochemical Equivalent of Silver," Phys. Rev., Vol. VII, No. 39. The second paper was by myself and Professor Guthe on "An Absolute Determination of the E.M.F. of the Clark Cell," Phys. Rev., Vol. IX, No. 5, 1899.

We found that the large and small coils of our former electro-

dynamometer were not sufficiently stable in form, and we did not get their dimensions with as great accuracy as we desire. Hence we are rebuilding the instrument entirely and are measuring every part with the greatest accuracy. The large coil, wound on a plaster of Paris cylinder 47 cm. in diameter, is now done, and the porcelain cylinder, made at the Royal Porcelain Works in Berlin, is nearly ready for winding. Methods and instruments for measuring these coils have had to be invented, but the difficulties are now apparently overcome.

A large number of Weston cells, with excess of cadmium sulphate crystals, have been made and they have been under comparison for several weeks. More will be made soon. We shall first measure the E.M.F. of the cadmium cell, and subsequently shall redetermine the silver equivalent. On account of the extreme care given to all details, the work has progressed slowly; but we hope to have some preliminary measurements of the E.M.F. of the cadmium cell made before the coming meeting of the American Institute of Electrical Engineers at Niagara Falls. In both these determinations we get, of course, an absolute measure of the ampere. We have standard resistances with Reichsanstalt certificates, and these we assume to agree with the certificates..

HENRY S. CARHART.

ANN ARBOR, MICH.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

An interesting Phenomenon in Compensated Motors.—HEYLAND.—An article illustrated by diagrams. The author had repeatedly observed in experiments with compensated motors, that the rotor losses, that is, the copper losses in the short-circuited armature, after connecting the compensator, did not become greater, but were even less than in the ordinary motor. If the same motor worked first with a simply short-circuited rotor and then with a compensated rotor at the same load, the heating and the losses measured in the rotor were less in the compensated than in the normal motor. This seemed very surprising, for while for the stator a decrease of the losses on account of the improvement of the power factor was self-evident, it should have been supposed that the losses in the rotor would increase, because the induction currents in the rotor are increased in the compensated motor by the magnetizing currents which are introduced through the commutator. Experiments were made with motors which carried collector rings, and the short-circuited armature was connected with an amperemeter, which was introduced into the circuit of the collector rings. It was then found that the rotor current in the compensated motor was only greater for small loads, but at normal load and from ⅓ of the load upwards, was smaller in the compensated motor than in the ordinary motor with short-circuited armature. The phenomenon was investigated graphically and the explanation was found in the negative leakage of the compensated motors. It is well known that in such motors the field of the rotor is greater than that of the stator. The tractive power is quite generally determined by the product: common field × induction currents, and as in the compensated motor the field common to the stator and rotor becomes larger than in the ordinary motor, therefore, for a given tractive force the induction currents will become proportionately smaller. This difference is so considerable that beginning with a certain load the total current resulting from induction current plus magnetizing current in the rotor is smaller in the compensated motor than the induction currents alone in the ordinary motor. The author states that this result is of great practical significance, as it shows that it is not necessary, as was stated formerly, to increase the winding space in the rotor. On the contrary, the rotor with the same copper can be considerably more loaded, without passing the heat limit. In the stator, in consequence of the absence of the wattless component, the heating becomes the same, if the power is increased in inverse proportion of the power factor. The iron losses remain the same. In the rotor it is possible, if desired, to go still higher, for the iron losses can be neglected altogether. The heat limit of the copper will generally not be reached on account of the better ventilation in the rotor, and the slip in any case becomes less in the compensated motor, because it is proportional to the losses by the induction currents. A 5-hp motor, therefore, furnishes about 7 hp with the same heating, when running as a compensated motor. The efficiency of the same motor increased from 78 to 81 per cent.—*Elect. Zeit.*, May 28.

Ageing of Iron Sheets.—STERN.—A long article with a number of tables and diagrams. The tests of the sheets covered a period of 5 years, from 1897 to 1902. Immediately measurements were made with 7 rings, composed of 32 sheets, each 0.35 mm thick. Each ring received two windings, such as are necessary for ballistic investigations. The windings were of such dimensions that the rings could be connected to a 52-volt alternating current, of a frequency of 125, when the saturation of the iron was about 8,000. Three rings were exposed to a dry heat of about 100° C, 3 rings were connected to an alternating current and an incandescent lamp, so that the average temperature of the rings was 45° C. The seventh rnig was kept at the temperature of the room for control measurements. The examination of the rings was for the purpose of investigating a statement made by Mordey and Blathy, that the reversal of magnetization has no influence on the ageing, which at high temperatures would take place also without demagnetization. Therefore, it was expected that the first three rings would age considerably, but no ageing would take place with the other three rings, as they were only heated to 45°, and the change of magnetization should not have any influence. The percentage of ageing, that is, increase in hysteresis loss, of the first three rings, was found after 40 days' heating, as 56 per cent., 45 per cent. and 31 per cent., respectively, but the hysteresis loss in the other three rings had also increased after 15 to 17 months by 20 per cent., 15 per cent. and 8.5 per cent. The greatest surprise, however, was furnished by a measurement of the seventh ring, which should have served as control. This had only been exposed to the ordinary room temperature, but it was found that an average increase of hysteresis loss of 12 per cent. had taken place after 17 months, and from $B = 4{,}000$ to 10,000 quite evenly; the magnetization curve had also received another form. Other observations on the same line cause the author to make the following statement: "It must be regarded as an incontestable fact that iron at the temperature of the room can also show in time a not inconsiderable increase of losses by hysteresis." The conclusions drawn from a long series of measurements are the following: 1. Ageing of sheets of iron can take place at every temperature. 2. A sheet with a small coefficient of hysteresis has in general a greater inclination to ageing than a sheet with a large one. 3. In an ageing sheet this coefficient grows for small inductions in a greater degree than for high ones. 4. Consequently, the permeability decreases at small inductions with the ageing more than at high inductions. 5. An annealing of the sheets after punching (or cutting) is at best without value, mostly detrimental. 6. There is iron, which shows between room temperature and 100° none at all or an inconsiderable increase of losses. 7. A number of German rolling mills, after having formerly manufactured a strongly ageing material, is to-day in a position to furnish sheets which do not age at all or only to a small degree. 8. As there are still manufactured to-day strongly ageing sheets, continuous control measurements are to be advised. 9. A limiting clause in regard to the temperature of cyclically magnetized iron in machines and transformers cannot be recommended in view of 6 and 7.—*Elect. Zeit.*, May 28.

REFERENCE.

Induction Motors with Commutator.—BRAGSTAD.—The conclusion of his long theoretical article on polyphase induction motors, with commutator and shunt excitation, previously noted in the Digest.—*Elec. Zeit.*, May 28.

POWER.

Electric Driving in Machine Shops, Engineering and Shipbuilding Works.—The continuation and conclusion of the article previously

noted in the Digest. The paper by Williamson deals entirely with the work carried out in the various establishments of Vickers Sons & Maxim, Limited, in which the aggregate horse-power of generators and motors amounts to about 22,500 B.hp. The whole of the generating plant is of the continuous-current type, delivering current at 220 volts, and all the dynamos are shunt wound. The fact that there are some 1,300 motors in daily use, switched on and off by the workmen in charge of the various machines, and that in spite of the rough usage they are subjected to, they take care of themselves remarkably well, speaks well for continuous-current motor driving. A table is given showing the summary of generating costs for one year, from which it appears that at North Sheffield, with 640 kw-capacity and a fuel cost of $2.42 per ton, the total cost per unit was 1.43 cents, while at South Sheffield, with 1,325-kw capacity and fuel at $1.80 per ton, the total cost per unit was 1.35 cents. The capital outlay on plant and buildings at North Sheffield was $99.05 per kw, and at South Sheffield $125 per kw. A detailed analysis of the cost of generating at the two Sheffield works is given. The day load is 5,150 amp. and the night load 4,500 amp. The application of the motor drive to a vertical portable planer or slotting machine is described, where the novelty of the application lies in the insertion and short-circuiting of a shunt resistance, which takes place when the motor is reversed at the end of the down stroke of the tool, so that the return stroke is made at the rate of 900 r.p.m., while on the cutting stroke the motor runs at 300 revolutions. The reversion of the motor and the insertion and cutting out of the shunt resistance take place automatically. A number of valuable data are given to the actual power consumed by a large number of various tools when doing specific work, and the amount of metal removed per B.hp-hour. Among the tools mentioned are large gun-goring lathes, heavy armor plate planers and other heavy machinery. On a Wellman charging machine for steel furnaces three 25-hp tramway motors are used, one each for the traveling, traversing and lifting motions, and a 5-hp motor for the turning gear. The power taken varies from 7 to 70 B.hp. The tubs hold three tons, and a 40-ton furnace is charged in half an hour, as against four hours by manual labor. The advantages over manual charging are a reduction of 50 per cent. in wages, an increased output of 25 per cent. and a reduction in the cost of repairs. The power for line shafting in the works varies from about 5½ to 13 B.hp per 100 ft. of 3 to 3½-in. shafting, the average being 9.1.—Lond. *Elec. Rev.*, May 22 and 29.

Electric Drive in Rolling Mills.—ANDREEN.—The author first discusses the question of speed regulation as required in rolling mills and comes to the conclusion that continuous-current motors are best suited for the peculiar conditions met with. A recent installation at a rolling mill in Sweden is then described. In the generating station there are two 170-kw dynamos, driven each by a water turbine of about 250 hp. The generators are of the compound type and run at 550 volts and 310 amp. at full load. The motor is directly coupled to the rolls and furnishes normally 400 hp. It has two commutators, which can be connected in series or parallel, and is compounded, but less than the generators. The speed can be varied from 140 to 500 revolutions, and the motor runs sparklessly at a constant position of the brushes and at all loads. The load conditions are very difficult, diagrams showing that it rises and falls during a few seconds from a maximum to nothing. As the motor is built for constant speed, there is no fly wheel necessary on the rolls and the important advantage is obtained that the rolls can work at a uniform speed, by which means the production is enlarged, the work simplified and the percentage of scrap considerably decreased.—*Teknisk Tidskrift*, translated in *Elek. Anz.*, May 17, 24.

Equipment of Machine Shops.—HORNER.—A discussion of the questions that come up in this connection. In regard to the question of electricity versus compressed air the author states that they are rivals to a certain extent, but only within a comparatively limited area. "The latter agency scarcely touches the driving of machine tools outside of the portable types, nor is it used much for hoisting tackle, excepting in the lighter class of traveling crabs and hoists. It is not a serious rival to electricity in the heavier cranes, whether they are of the fixed or traveling types. . . . The elasticity of the electric system as well as its potential economies, explains and justifies its phenomenal growth." The article is well illustrated.—*Cass. Mag.*, June.

Tests of Electrically-Driven Shop Equipment.—MOORE.—An article giving a table of tests of the power required for various tools, such as drills, planers, punches, rail benders, under actual working conditions. Among the data given for the various tools is the voltage and amperage of the starting current, the time required to start, voltage and amperage of the current while the tool was running, the average developed horse-power, and the revolutions of the various motors per minute. Alternating current is used in the plant. The tests occupied a period of one hour, the machines during this time running under ordinary service.—*Eng. News*, May 28.

Oiling System for Power Plants.—MOOCK.—An illustrated description of an oiling system which supplies sight-feed nozzles with oil under a constant head, regardless of whether the supply tank is full or almost empty. The main supply tank has upper and lower gauges, showing the level of the oil, a supply pipe running to the engine. Tapped into this pipe is a stand pipe having a hole in the side near its upper end, which end is closed to keep out the dirt; a valve is situated at the top of the tank for filling purposes. When the tank is first filled the oil rises in the stand pipe to the same height as in the tank; the valve at the top of the tank is then closed, and the oil in the stand pipe will feed to a point where a little air will force its way into the bottom of the tank, thereby allowing more oil to run out, and this point will be the constant oil level. The sight-feed nozzles are all on the same level and when once properly set, need never be shut off, a valve being placed in the main feed pipe for that purpose.—*Amer. Elec.*, May.

REFERENCES.

Size of Motors Required to Drive Presses.—FLADD.—An article giving a compilation of a number of presses of different kinds in actual operation and the horse-power of the motors required to drive them.—*Amer. Mach.*, May 28.

The Electric Motor in the Machine Shop.—KIMBALL.—A long, well-illustrated article. The author discusses the speed requirements for the various tools at considerable length.—*Eng'ing Mag.*, May.

Power Test of Group Drive Motors.—LEWIS.—An article, illustrated by tables and diagrams, on an elaborate series of tests recently made at the Roanoke shops of the Norfolk & Western Railway, to determine the power required by the various group drive motors for machine driving.—*Am. Eng. & Railr. Jour.*, June.

Motor-Driven Shafting Lathe.—An illustrated description of a recently-designed machine.—*Am. Mach.*, May 28.

Motor-Driven Machine Tools.—An illustrated article giving examples of individual drives applied to boring mills.—*Am. Eng. & Railr. Jour.*, June.

Electricity in French Slate Quarries.—A description of the electrical equipment for lighting and power of the Société Ardoisière d'Anjou.—*Eng'ing*, May 22.

Mechanical Draft.—HUBBARD.—An illustrated article in which the author enumerates the advantages of mechanical draft over natural draft. Both the forced and induced draft systems are described.—*Amer. Elec.*, May.

Pipe Coverings.—STROHM.—An illustrated article giving the various requisites of a good steam pipe covering and describing many of the more efficient forms.—*Amer. Elec.*, May.

TRACTION.

Electricity for Railway Purposes.—An abstract of a report on recent progress in railway engineering, published by the Union of German Railway Companies, to which 65 companies in Germany, Austria, Luxemburg, Bosnia, and the Netherlands belong. Electric lighting of passenger cars by the systems of Stone and Dick is tried in a few cases, but sufficient experience has not yet been obtained. Electric lighting with accumulators alone is tried by various companies, and is in regular use in a considerable number of cars; the results are said to be generally good, but the cost is higher than with oil gas lighting. For signals, electric light is used in only a few cases. From the experience of the Würtemberg, Palatia and Arad-Csanad Railways it appears that an automobile service on rails either with benzine, steam or accumulators, is practicable; the choice of the one or the other system depends upon local conditions, and the grades of the road. Grades limit the use of the accumulator car in a higher degree than the use of benzine or steam cars. Whether accumulator cars are commercially successful, depends greatly upon the cost of the current. Simplicity of operation and lack of noise and smell are advantages of the accumulator car over the benzine and steam cars. Electric power is used for various purposes; devices for setting switches and signals, operated by electric current, have

been used by eleven railways for several years, and it appears that if properly and carefully maintained, these devices are reliable and successful. One railway company states that these electric devices are more reliable than mechanical devices; whether the signals and switches have been really set correctly, is at once evident in the setting device; for large distances the accuracy of setting the switches and signals is the same as for near distances. It seems that for greater installations less attendance is required with electric devices, but their cost is higher, and for this reason their introduction is recommended only where electric current is already available for lighting and power. A setting device with 10 switches and three signals, operated by compressed air in conjunction with electric current, is in use on the Bavarian railways, and has proved reliable. Electric block systems have been found to be successful.—*Elek. Zeit.*, May 21.

Electrical Traction on the Northeastern Railway (England).—An illustrated article descriptive of the adaptation of several suburban lines of the above railroad to electric motive power, which is in progress. The trains will be operated by continuous current, obtained from a single collector rail placed in the 6-ft. way, with a return circuit through the running rails, but the position of this rail has been so fixed that a return collector rail can be installed between the rails if required in the future. Three-phase current at 5,500 volts and a frequency of 40 per second will be transmitted to sub-stations, where it will be transformed by stationary transformers and rotary converters into continuous current of 600 volts. Fourteen 800-kw rotary converters will be distributed among the sub-stations, and in order to meet the excessive fluctuations of the load, they have been designed to operate without serious sparking at an overload of 100 per cent. for 10 minutes, and at an overload of 200 per cent. momentarily. The main transformers are of the single-phase, oil-insulated, self-cooling type. To each rotary converter is coupled a small induction motor, fed by a special transformer, which will run the rotary up to synchronous speed. The high-tension switches will be of the oil-break type, the feeder switches being provided with an automatic reverse-current release, all being operated electrically by low-tension continuous current, for which small batteries are provided. The unit train will be composed of two motor coaches, with one trailer coach between them. For collecting current from the live rail each motor car carries four contact shoes, connected together so as to maintain contact at junctions, etc. The generating plant in the station is to consist of Parsons steam turbo-generators, each of 3,500-kw capacity, with an overload capacity of 5,000 kw for two hours.—Lond. *Elec.*, May 29.

Recent Developments in High-Speed Electric Traction in Germany.—Reichel.—A synopsis of a recent paper referring to results on the Berlin-Zossen line and the elevated railway of Berlin. On the latter line 800-volt, direct-current motors have been used with good results, and the Siemens & Halske Company has recently built 1,000-volt, direct-current motors. The author states that 3-phase motors can be built for 10,000 volts. A wiring diagram for a two-motor locomotive and a plan and elevation of a four-motor locomotive are shown. In the latter there are two 1,000-hp motors and two smaller motors, which can be connected in cascade to the larger motors when low speeds are desired. A table is given showing comparison between steam and electric trains at speeds of 160 km per hour.—*St. R'y Jour.*, May 16.

Installations, Systems and Appliances.

Charlottenburg.—Collischonn.—A well-illustrated description of the electric central station of Charlottenburg, near Berlin, Germany, supplying current for lighting the town and various railroad stations in the neighborhood, and for the tramway lines in the same town. The company is said to be very successful, 85,000 lamps being connected at the present time, which is only two and a half years after commencement of operation. The station contains one 3,200-volt, three-phase generator of 1,160 kw normal and 1,430 kw maximum non-inductive capacity, two 440-kw, 3,200-volt, three-phase generators, one 220-kw, 3,200-volt, three-phase generator, and two 440-kw, 600-volt, direct-current generators, all machines running at 94 r.p.m. Each of the two direct-current dynamos is coupled with a 440-kw, three-phase machine, driven by a 500 to 650-hp steam engine, while the other generators each have their own steam engine. Two synchronous converters, each of 75 kw, running at 1,000 r.p.m., give the exciting current for the three-phase machines, for lighting the station and for driving the motors for condensation. These converters are operated in parallel with a battery giving 810 amp-hours when discharged in three hours. The three-phase currents are transformed from 3,000 volts in two 85-kw transformers to the primary voltage of 70 of the converters, which give direct current at 110 volts. The switchboard is so arranged that all measurements are made on low-potential circuits, there being only several switches for the high-potential lines on the board, but these are about 9 ft. high, so that they are not readily accessible and do not constitute a source of danger for the attendants. The measuring coils taken from the high-potential coils of the alternators have a potential of 50 volts, and are so arranged that each phase may be measured. Static voltmeters are used on the high-potential circuits to detect grounds. When a feeder has been grounded it can be used as return wire and the former return is then connected as feeder. High and low-potential circuits are connected by 105 transformer stations, in which the voltage is transformed from 3,000 to 120 or 225 volts. The transformers have three vertical cores, which are united into one magnetic circuit by sheets at the top and bottom. The primary and secondary are arranged concentrically above each other and are separated by an insulating ring. A number of tables and diagrams are given.—*Elec. Zeit.*, May 21, 29.

Electro-Physics and Magnetism.

Condensation of Radio-Active Emanations.—Rutherford and Soddy.—A long, illustrated paper containing the announcement of a very interesting discovery, namely that it is possible to condense the so-called emanations from thorium and radium, and that they behave just like vapors. The emanations are passed through an apparatus consisting of a double copper spiral, immersed in a glass cylinder filled with liquified ethylene, which in its turn is immersed in a copper vessel filled with liquid air. If the emanation from either of the above elements is conveyed by means of a slow current of hydrogen, oxygen or air, through the apparatus, the conditions can be so regulated that no trace of the emanation can be found in the gases issuing at the outlet of the apparatus. The spiral copper tube in which the emanations condensed was employed as its own thermometer, by determining its electrical resistance. The apparatus is

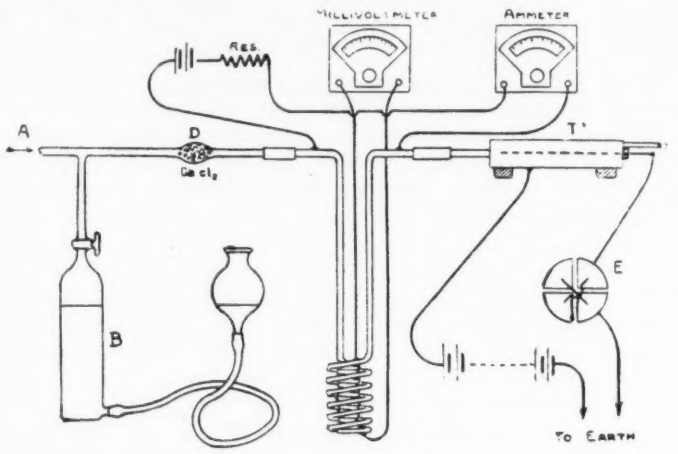


DIAGRAM OF APPARATUS.

shown in the accompanying diagram. *A* represents the entrance of the gas. The radium emanation mixed with air is stored in *B*; *D* is a drying tube containing calcium chloride. The ammeter is in circuit with voltameters serving for the generation of the conveying gas, and the current indicated by it furnishes a measure for the quantity of the gas. *T* is a testing cylinder in connection with an electrometer, *E*, by which the presence or absence of emanations in the issuing gases is detected. The radium emanation condenses at a temperature of 150° C. and the thorium emanation at 120° C. The condensed emanations can be volatilized again by suddenly removing the spiral from the bath of liquid air. The conclusion reached by the authors is that the emanations possess the usual properties possessed by ordinary gaseous matter, in so far as the phenomena of volatilization and condensation are concerned. These new properties, taken in conjunction with the earlier discovered diffusion phenomena, characteristic of the radio-active emanations, leave no doubt that the latter must consist of matter in the gaseous state.—*Phil. Mag.*, May.

On the "Emanation Substance" from Pitchblende.—GIESEL.—An article under the above heading by the well-known investigator on the subject of radio-activity, giving the steps by which he succeeded in separating a new radio-active substance from pitchblende. Experiments on the physical properties of the emanation proceeding from the above substances, are also detailed. The author arrives at the conclusion that the emanation experiences in the electric field an acceleration in the direction from the positive to the negative electrode, and that it must itself possess a positive charge. The emanation of the substance is very different from that of radium. The name "E-rays" is suggested for the new rays.—*Berichte der Deutsch. Chem. Gesellschaft* 35, 3608; translated in *Scien. Am. Suppl.*, May 16.

Magnetism and Thermal Conductivity.—BLYTH.—An account of an experimental investigation of the influence of a magnetic field on thermal conductivity. The change in the thermal conductivity of bismuth produced by a magnetic field is very small; for a transverse field of 3,550 C. G. S. units it is considerably less than ½ per cent., and it is scarcely measurable even in higher fields by any of the methods used. As tested by the bridge method, mild steel suffered a reduction of its conductivity of 3.3 per cent. for an increase of transverse field of 7,500, and a reduction of 2.1 per cent. for an increase of 6,700. The reduction, 3.1 per cent., was observed for the same material by the method of direct measurement on application of a transverse field of 6,500. The effect of a longitudinal field of 51 C. G. S. on the conductivity of mild steel was to diminish it by about 4 per cent. In the case of soft iron, as tested by direct measurement, a longitudinal field producing a magnetic induction of 16,000 per sq. cm., diminished the conductivity about 10.6 per cent., while the effect of a transverse field is comparatively small, about 1 per cent. for a field of 7,850; by the bridge method the effect of a longitudinal induction of 17,500 was found to be a diminution of conductivity of 10.2 per cent.—*Phil. Mag.*, May.

ELECTRO-CHEMISTRY AND BATTERIES.

Nickel Cathodes.—BROWNE.—An account of experiments on depositing nickel sheets of some thickness. The difficulty is the tendency of electrodeposited nickel to crack and curl off in rolls, like wood shavings; the wood shavings curl into a helix because they are compressed on one side or expanded on the other, and a similar difference in surface tension causes the curling of nickel deposits. The author discusses the results of the fact that the solution near the cathode becomes poor in nickel ions during the process of electroplating; any condition which aids the replacement of the ions helps the deposit to remain flat; circulation is, in this respect, most efficient. With a difficultly soluble salt no replacement, however fast, is certain to prevent local irregularities; hence the use of well-soluble salts, as nickel chloride, is of great benefit; heat is also useful by giving mobility to the liquid and by causing eddies therein; but better than all, is the employment of a steady current density. The entire art of the production of solid nickel deposits of almost any desired thickness consists in maintaining initially good conditions to the end. He gives the results of experiments made on the deposition of nickel sheets on graphited cathodes of rolled block tin, with varying densities of a solution of nickel chloride and common salt, with varying temperature, current density and acidity. The best results were obtained with a neutral solution of about 70 g. nickel chloride and 180 g. sodium chloride per liter, a current density of 100 to 200 amp. per square meter with efficient circulation; heat increases the flexibility. All cathodes made in this way have, however, a slight outward curl, which curl increases with the current density. The curling is always toward the anode and around the longer axis of the rectangular cathode, irrespective of the way in which the cathode hung in the bath. A test was made to determine the extent of curvature given by a certain current; this being established, an anode was curved to the same radius, and a cathode was fastened to a backing of the same, but with reversed curvature; the plating was then performed in exactly the same manner as before; when the cathode had attained the desired thickness it was stripped from the backing and then sprang into a perfect plane surface. The author suggests the use of a curved cathode to measure the intensity of surface tension of deposits under varying conditions.—*Electrochem. Ind.*, June.

Electrolytic Synthesis of Sugars.—An article on experiments by Walther on the synthesis of fruit and grape sugar by electrolysis, with an electrolyte charged with carbonic acid and with or without the addition of ammonium sulphate or phosphate and vegetable albuminoids. The products of the electrolysis are oxalic, tartaric and citric acids, fruit sugar and grape sugar in the order named. Careful control of current, e.m.f., concentration, temperature, etc., are necessary. Brushes of platinum wire are used as anode, while for cathodes various metals, such as platinum, silver, etc., or clay mixed with magnetic oxide of iron or carbon, are employed.—*Chemiker Zeitung*, August 16 and October 18, 1902; *Eng'ing*, May 1.

The Dissociation Theory in Medicine and Biology.—BANCROFT.—A paper on some applications of the electrolytic dissociation theory to medicine and biology. He first discusses the hypothesis that certain ions give a certain color to a solution and the hypothesis that certain ions have a toxic action on certain plants or animals. On the other hand there are other factors to be taken into account besides that of electrolytic dissociation. The properties of a substance are a function of the degree of saturation as well as of concentration. The dissociation theory is useful in the field of reaction velocity. He offers an explanation of the way that hydrochloric acid gets into the stomach. He refers to the acceleration of the reaction velocity by colloidal metals, platinum, silver, etc., or so-called ferments. In conclusion he discusses the importance of the behavior of semi-permeable membranes in plant life.—*Electrochem. Ind.*, May.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Thermostat Heated and Regulated by Electricity.—MARIE AND MARQUIS.—A paper presented to the French Academy of Sciences. The thermostat consists of a receptacle of glazed stoneware of about 15 litres capacity. The heating is done by a platinum wire, which is transversed by a current, and the liquid is agitated by a stirrer, driven by a small electric motor. The regulation of the temperature is effected by acetone, arranged in a glass vessel above a layer of mercury, which is in contact with a platinum point. The expansion of the acetone forces the mercury away from the platinum point, and this breaks another circuit, which, through connection with a relay, interrupts the heating current. The apparatus is stated to keep the temperature constant within 2° or 3° C. The description is illustrated.—*La Revue Technique*, May 25.

Construction and Attachment of Galvanometer Mirrors.—WATSON.—An abstract of a Phys. Soc. paper. To overcome the difficulties arising from the attachment of the fibre to glass mirrors and the necessity of varnishing the mirrors, the author uses disks of fused quartz instead of glass. A small tag of quartz is fused to the edge for the attachment of the fibre. A reflecting surface of platinum is deposited on the quartz disks by coating them with a platinum solution and exposing them to red heat, when platinum is deposited.—Lond. *Elec.*, May 22.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Automatic Telephone Systems.—O'BRIEN.—An illustrated article describing the Ness automatic intercommunicating telephone system, which system is applicable to all installations of private telephones where a number of instruments are to be connected in an intercommunicating relation, the standard switches having 10, 16, 20 and 24 points. The system may be connected so as to use one central ringing and talking battery, or may be installed to use central ringing batteries and individual talking batteries located at each station. The automatic switch is intended not only to enable the user of the telephone to signal and obtain connection with any other station on the system, but also to bring the instrument into its normal connection with the line when the conversation is finished and to restore the bell connections so that the instrument may be signalled by any other station. This result is obtained by the action of the user in replacing the telephone receiver upon the hook.—*Amer. Elec.*, May.

REFERENCES.

Wireless Telegraphy and Railroading.—SCHMIDT.—The first part of an illustrated article on the application of wireless telegraphy to railways.—*Elek. Anz.*, May. 14.

Wireless Telegraphy.—GUARINO.—An illustrated article on the development of Marconi's system of wireless telegraphy.—*Sc. Am., Sup.*, May 9.

Submarine Telegraphy.—FOURNIER.—A popular illustrated description of the Pierre Picard system, in use in three French cables.—*Cosmos,* May 16.

New Installations for the Safety of Trains on Railroads.—A description, illustrated by diagrams, of the Rudolf Bartelmus automatic electric block signal and Miller's block system, giving signals on the locomotives.—*Dingler's Poly. Journ.,* May 23.

System for Prevention of Collisions Between Trains.—A short description of the Basanta system, which uses a wire running along the rail of the track, connected with a telephone and alarm bell in the cab of the engine. The invention works somewhat like the block system and the bell rings automatically, when two trains are in the same block.—*Scien. Am.,* May 16.

New Telegraph Installation in Brussels.—A long illustrated article containing a detailed description of the arrangement and switchboard, to put the different lines in connection with each other.—*Journ. Telegraphique,* May 25.

Telephone Engineering.—DOMMERQUE.—Another article of the series on telephone engineering; it treats of wire. The author gives various tables for the resistance, weight, strength, etc., of the various standard wires, with temperature coefficients and formulæ for making temperature corrections.—*Amer. Elec.,* May.

New Books.

TELEPHONY. By Arthur V. Abbott, C. E. New York: McGraw Publishing Company. Six Volumes. Part I.—The Location of Central Offices, 170 pages, 33 illustrations. Part II.—The Construction of Underground Conduits, 190 pages, 62 illustrations. Part III.—The Cable Plant, 153 pages, 41 illustrations. Price, per volume separately, $1.50; Set of six, $6.

These three neat and compact volumes are the first of a series of six manuals which have been prepared by Mr. Abbott, the well-known electrical engineer, who was at one time connected with the Chicago Telephone Company, and who has given special attention to the subject of telephony for several years past. These volumes now issued are based upon the valuable series of articles which Mr. Abbott has contributed to the pages of ELECTRICAL WORLD AND ENGINEER. In bringing the matter into book form, Mr. Abbott seized the opportunity to revise his text and to embody various corrections and suggestions which have been required, or put forward by readers and critics. There is nothing exactly like these volumes now before the electrical public, and in view of the tremendous extension that is now being given to the telephonic art, they should undoubtedly be of great utility and enjoy a wide circulation. Most of the books available on the subject of telephony have been written from the standard of describing apparatus in the shape of switchboards, receivers, transmitters, etc., as well as aerial lines and underground cables sometimes. But Mr. Abbott has pushed much further afield than this, and in Part I. has discussed the location of the central office of an exchange system or district, and has presented a great variety of interesting considerations with regard to the determination of the telephonic center and the effect of displacing it or of subdividing the territory.

Parts II. and III., while dealing with matter which is more familiar, namely, underground conduits and the cable plant, are also fuller than usual of what one may call the theory of the subject, although the practical aspects are in no wise neglected. The opening chapter of the second part, for example, deals with the principles of circuit design, and the second chapter with questions of mechanical properties. Incidental to all these volumes is the use of a large number of diagrams and curves of great practical value in figuring out questions of cost as well as in determining certain physical qualities in connection with the work. Another unusual and unique feature is the inclusion in Parts II. and III. of elaborate specifications profusely illustrated with cuts, and entering into all the details of the work, so that they can be used as regular contract and specification forms.

In these books the main point which impresses the reader is that Mr. Abbott brings the central station manager face to face with the questions and problems of cost, which, as he intimates, are always vital; and we believe that the information thus rendered available will be appreciated by all those who are now engaged in the development of the industry, particularly if it is to them a somewhat new field of which the difficulties and elements have to be mastered. It is possible that to some of our telephone readers connected with smaller exchanges, portions of the discussions in Part I. may appear rather verbose and recondite, but the points which Mr. Abbott raises are an essential feature of telephonic engineering, and so far as we are aware they have never been discussed before in public. Hence it was high time that a treatment of the subject was available, and while all to whom the discussion appeals may not agree with Mr. Abbott in his conclusions, they will find it suggestive and illuminating to study his thoughtful pages.

The books are simply and substantially got up with good type, and are profusely illustrated by a large number of new cuts made specially to accompany this text. The remaining three parts, which are to appear in due course, will deal with open-wire lines, the substation, switchboards, and the central office.

Directory of Electrical Societies, Etc.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, Secretary, Ralph W. Pope, 95 Liberty Street, New York. General meeting, Niagara Falls, June 29, July 3.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting Atlantic City, N. J., September 2, 3 and 4, 1903.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Annual Convention, Detroit, Mich., July 14, 15 and 16. Frank J. Miner, chairman Exhibition Committee, 207 Jefferson Ave., Detroit.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ware, Ellicott Sq. Building, Buffalo, N. Y. Next meeting, Chicago, June 24 and 25.

Electrical Apparatus in Coal Mining.

BY S. B. BELDEN.

In regard to the utilization of electricity in mining, some interesting data is given by the Jeffrey Manufacturing Company, of Columbus, Ohio, with respect to new apparatus it is now introducing. Miners are now well disposed towards such machinery, but it is said that the public will probably never know the trials and expense attendant upon the introduction of the first chain machines by Mr. J. H. Jeffrey, president of the company. The height of the first machines precluded the possibility of operating them in thin coal, and for several years no attempt was made to build a machine designed for this work. Even after the chain machine was an established success, neither the coal operators nor the manufacturers of the machines believed that a machine weighing over one ton could be operated in coal ranging from 32 in. to 36 in. The standard machine having proven so successful in thick veins, these large machines began to be used in lower coal until finally the minimum vein, so far as these machines were concerned, was reached. One fact, however, was clearly demonstrated, which was that the weight of the machine was not such a serious obstacle. The designers were given the problem and a smaller and lighter machine was brought out by the Jeffrey Manufacturing Company. Its height over all is only 18 in., but as a truck is essential for moving it from room to room, it is necessary to allow for a height of 28 in. when so mounted. The total weight of this machine is in the neighborhood of 2,500 pounds, and as it has been designed to have a wide flat shoe board to rest on, it can be moved along the face of the coal by the machine runner and his helper with ease.

The parts are made as light as possible consistent with the work to be performed, but in no instance was a pound of metal sacrificed which would affect either the durability or the strength of the machine. Two steel channel bars and two angle irons riveted to steel cross ties form the outside frame, in which rests an inside sliding frame consisting of a heavy channel, or center rail, to which is bolted the cutterhead. This cutterhead is made entirely of two milled steel plates, which, bolted together, form the front guide for the cutter chain. The chain, which is made of cast-steel solid links connected

by drop-forged straps, passes around idlers, or sprockets, located at each side of the cutterhead, and then along the chain guides to the rear of the machine, where it receives its power from a third sprocket located under the motor. The motor is of the iron-clad multipolar type and was designed especially for this low-vein machine. The motor rests upon a steel carriage which forms the bearing for the main shaft. A feature, which is essential to the successful operation of low coal, is that the thin-vein machine is equipped with a self-propelling truck. Where the grades are heavy this truck operated by the mining machine motor is of extraordinary advantage, and where the room lies to the dip it obviates the necessity of brushing down the roof for the mules.

Many mines now having only 28 in. to 30 in. of coal are being operated entirely by the thin-vein machine. While the data received from these different mines varies, owing to the local conditions, it is safe to say that a fair average will show these machines to be capable of under cutting at least 50 tons of coal per shift. Nearly all of these plants work two eight-hour shifts, so the output of a machine working in such a vein can be considered as 100 tons per day. Four hundred tons represents the daily output of many small mines and it might not be amiss to show the approximate cost of an electric plant of this capacity.

The average amount of power required by each machine has been estimated to be about 15 kw, so a 75-kw dynamo would furnish sufficient power for the simultaneous operation of four machines and still have excess power for electric lights or for small motors, which might be added for pumping or ventilation. In order to have at all times sufficient boiler power I would recommend a 72 x 18 150-hp return tubular boiler. At first glance this would seem to be too great an excess of boiler power, but actual experience has demonstrated that this proportion is more economical in the end. The following machinery then would be necessary for a plant to produce 400 tons of coal per day in a 3-ft. vein of coal: One 72 x 18 return tubular boiler, one duplex boiler feed pump, one feed water heater, one injector, one set of steam fittings, one 13 x 14 simple automatic engine, one double leather dynamo belt, one 75-kw generator, one marble switchboard and instruments, one complete station equipment, four low-vein machines, four self-propelling trucks for the same. Approximate prices: Plant, $4,100; four machines, $4,000; four self-propelling trucks, $400; total, $8,500.

To this price would be added the cost of the foundation, the cost of installing the machinery, and the cost of the necessary copper wire to conduct the electric current from the power house into the mines. It is safe to figure on $10,000 covering the necessary expenditures for this plant.

It is difficult to say exactly what the depreciation of an electric plant is, and it is even more difficult to say what the depreciation of a chain machine is, for the first Jeffrey mining machines put on the market over 25 years ago are still in daily operation. A large amount of data received from various mining sections bearing on the cost of mining machine maintenance per ton of coal cut gives figures ranging from one-tenth of a cent to two cents per ton. One can easily appreciate the variation of these figures by considering first the quality of the coal being mined, and second the care which is taken of the machinery. It is only natural that a hard coal full of sulphur in the "bearing in," will cost considerably more per ton to mine than a soft pure coal. It is also true that two machines working in the same territory or even in adjoining rooms, will show a difference in the cost of repairs, which can be traced to the different attention or care which they have received from their respective runners.

I have before me the mining scale recently adopted in number eight vein of Ohio coal. This scale gives: Pick mining in rooms, 90 cents; machine mining in rooms, 11 cents; loading after machine in rooms, 52½ cents.

This shows a difference between the two methods amounting to 26½ cents per ton. The four-machine plant figured on should produce at least 75,000 tons per year. If we allow a depreciation charge on the plant of 10 per cent. of its cost per year and 6 per cent. for the interest on the investment, and add to this the cost of producing the power (which our data sheets give as 1 9-10 cent to 2 1-10 cent per ton) and the largest cost of repair parts which we have ever known we still have a net saving of over 13 cents per ton. In other words, a plant of this kind will practically pay for itself within one year, by the net savings of the difference between the cost of the chain machine mining and the pick mining.

The Jeffrey Manufacturing Company builds electric locomotives in weights ranging from two to thirty tons, and, as with its mining machines it has designed special locomotives for operating in low coal. The dead work in the entries necessary to get sufficient height for mules in low coal mines, often adds no small amount to the cost of the production. The special low-vein locomotives were designed with a view of saving this roof brushing. The local conditions in the different districts govern the amount paid for such yardage, so it is difficult to name any definite amount which can be saved. However, I am familiar with one mine where the amount was $2.80 saved for every yard of entry driven. In this particular mine the strata instead of being level was rolling, and grades were encountered on the butt entries ranging from 2 per cent. to 7 per cent. By the introduction of a low-vein locomotive the operators were able to displace eight mules and four drivers. Counting each mule as costing 35 cents per day and the drivers $2.25 apiece, and deducting the pro rata share of the plant expense for the locomotive, they figured that they saved $8 per day by its use. Locomotives weighing four tons have been built by the Jeffrey Company, having a height over all of only 29 in. These are fitted with wheels outside of the frame and have a small enough wheel base to admit of their operating on any curve around which a pit car will pass.

The heavier locomotives have a greater total height. One has the following dimensions—it weighs 24,000 pounds and has a total height excluding the trolley of 39", the length over all is 9′ 4" and the wheel base is 40". It is designed to have an operating speed of from six to ten miles per hour, and will handle a gross train load of 150 tons on a level track at this speed. The Jeffrey Company has recently put out a locomotive which is fitted with a new device. The object is to enable the locomotive to reach the face of the coal in the rooms without using a trolley wire. As the rooms are continually being advanced the cost of wiring them and of keeping the wires within working distance of the face, would be considerable. This new locomotive receives current through a cable, one end of which is connected to a junction-box on the entry outside of the room neck. The cable is wound on a reel which is mounted on one end of the locomotive, and the current passing through the cable is conducted to the motors. As the locomotive leaves the entry on its way into the room the cable unwinds from the reel. When the locomotive starts out of the room with the loaded car, the cable automatically rewinds itself on the reel. At the junction-box in the entry it will be entirely rewound, and the locomotive can again proceed with the current taken from the trolley wire.

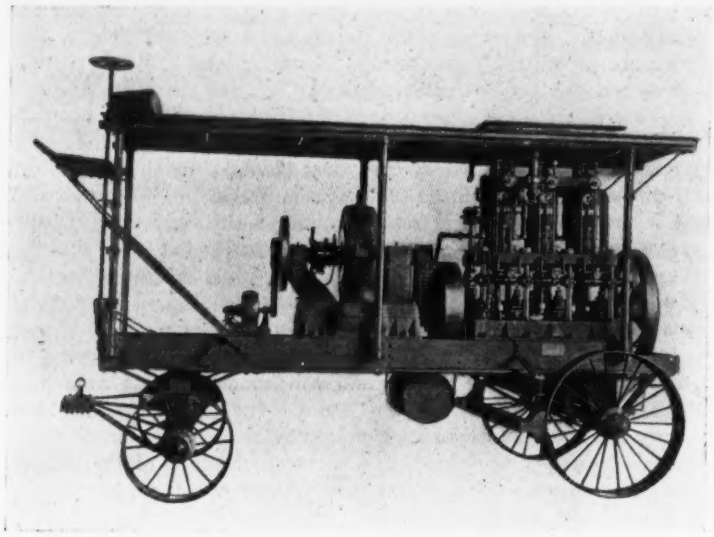
The cost of adding a locomotive to an electric mining plant already in operation is but very slight, as compared with the result which can be obtained. It is therefore advisable when installing a machine plant to provide for excess power if there is any possibility of using electric haulage in the future. The hauling being all done during the day shift, when a new plant is being installed it is considered economical to design it on the basis of operating more machines during the night shift and thus give the locomotive and a few machines the power during the day. Such an arrangement cuts down the initial cost of the power plant and seems to give absolute satisfaction. For instance, to consider a plant capable of cutting and hauling 1,000 tons of coal per day from a 4-foot vein of coal. The cost would be about $15,000.00 F. O. B. cars factory. Six of the machines would be worked during the night shift and four of them could alternate on the day shift. In this manner they would give the output required. A locomotive such as specified above, would be capable of hauling 117 tons gross train load on a level track at 8 miles per hour, and unless the grades were unusually heavy in the mine it could have sufficient power to produce the output figured on.

Equipment for D. L. & W. Shops.

The award has been made for the generators and engines for the new shops at Hoboken, N. J., and Scranton, Pa., of the Delaware, Lackawanna & Western Railroad. The generator contract, which was secured by the General Electric Company, calls for 1,050 kilowatts. There will be two 3-phase, 60-cycle machines, of 250-kw capacity each; a similar number of 200-kw capacity each, and one generator having a capacity of 150 kilowatts. They will be direct-connected to Ball & Wood cross compound engines, which will operate at 225 r.p.m. The engine contract calls for two of 375-hp; the same number of 300-hp capacity each, and one capable of developing 225 horse-power. These equipments will be used for both light and power purposes.

Nernst Lighting Plant for a Circus.

Reference was made recently in these pages to the fact that Ringling Bros., circus managers, had equipped a traveling lighting plant to supply Nernst lighting for one of their big circus tents. We are now able to illustrate this interesting little plant. The engraving herewith shows a Fort Wayne alternating-current generator connected to a Walrath 30-hp, three-cylinder gas engine, of the open-base type, built by the Marinette Iron Works of Marinette, Wis.



PORTABLE LIGHTING PLANT FOR CIRCUS.

The engine is connected to the dynamo by a Chicago Link Belt drive and the outfit is mounted on steel trucks. As a matter of fact, the outfit has been furnished in duplicate. In other words, there are two of these complete equipments which are being used for lighting the Ringling circus and animal tents, and the proprietors of the show express themselves as well pleased with the results obtained from these plants, which, of course, have to sustain a good deal of rough-and-tumble usage, and are transported from one end of the country to the other.

Status of the Kellogg Telephone Interests.

From one of the officials and minority stockholders of the Kellogg Switchboard and Supply Company we have received the subjoined statement in regard to the situation that has developed in the affairs of that company, as noted in these pages last week:

The Kellogg Switchboard and Supply Company was organized in 1897 with Mr. Milo G. Kellogg, of Chicago, its president and principal stockholder. In the fall of 1901, Mr. Kellogg's health broke down, and about November 1 of that year he was obliged to give up all business matters entirely, and left Chicago for California for an indefinite absence. Mr. Kellogg left the management of the company in the hands of Mr. Wallace L. DeWolf, of Chicago, who was then vice-president of the company, and entrusted Mr. DeWolf with a power of attorney for his entire personal property so as to provide for any financial emergency which might arise in his affairs and those of the Kellogg Company during his absence. Prior to Mr. Kellogg's departure a large amount of money had been expended in the increase of the plant of the company and an increase in the capital stock of the company to meet the expenditure was in progress, and a certain large customer and debtor of the company was in a precarious financial condition.

Shortly after Mr. Kellogg's departure, or about January, 1902, Mr. DeWolf sold Mr. Kellogg's entire interest in the company, amounting to about two-thirds of the entire capital stock, to Mr. Enos M. Barton, of Chicago, president of the Western Electric Company, and representing, it is understood, the Bell telephone interest. This sale was made without Mr. Kellogg's knowledge or consent and Mr. Kellogg was not advised of the sale of his stock until six months thereafter. At the same time, Mr. DeWolf sold his own stock, amounting to 202 shares, in the Kellogg Company, and effected the sale also to the same party, of the stock owned by Mr. Clarence Buckingham, of Chicago, a director in the Kellogg Company. No other director, officer, employee or stockholder of the Kellogg Company, save the secretary, was advised of the sale, and none of them knew of the sale until more than a year thereafter. No record of the transfer of stock was made on the books of the Kellogg Company, and all employees, and particularly those connected with the sales and engineering departments, were given the most postive assurance that there was no truth in the rumors that the Kellogg Company was controlled by the Western Electric interest.

On July 4, 1902, six months subsequent to the sale of his stock, Mr. Kellogg, having sufficiently recovered his health to inquire into the affairs of the Kellogg Company, was advised by Mr. DeWolf that his stock had been sold to Mr. Barton. Acting upon the advice of his counsel, Judge R. S. Taylor, Mr. Kellogg, as soon as his health permitted, began negotiations through his counsel with Mr. Barton, and with Mr. Frederick P. Fish, president of the American Telephone and Telegraph Company, for the repurchase of this stock. These negotiations have continued without interruption since the first of October, 1902, to the present time. Up to about the first of this year there was every prospect of these negotiations being successful, and that Mr. Kellogg would again obtain possession of his stock and the controlling interest in the Kellogg Switchboard and Supply Company so that he could again control the management of the Kellogg Company and could assure his friends and its customers that their interests would be protected and all of the obligations assumed by the Kellogg Company fulfilled to the letter. About the first of the year, however, Mr. Barton advised Mr. Kellogg and his counsel that it had been definitely decided to reject all propositions for the repurchase of his stock and that an additional price which Mr. Kellogg might offer for said stock would not affect the decision in this matter. Mr. Kellogg had already offered to repurchase his stock at a price which would net a large profit to the original purchaser.

Mr. Kellogg then appealed to the Bell interest to reconsider the matter from an ethical standpoint, that is, from the standpoint of the damage which would result to his friends and customers and employees of the Kellogg Company who had been placed in a false light by the action of both parties concerned in the sale of his stock. To this appeal the Bell interest also turned a deaf ear.

March 11, 1903, Judge R. S. Taylor, informed Mr. F. W. Dunbar of the condition of the Kellogg Company and its relation to the Bell interest. Mr. Dunbar was the first employee of the Kellogg Company to be informed of the existing situation and he took up the matter immediately with Mr. Kellogg, who placed the entire correspondence and records of the negotiations at his disposal, and explained all the details. The situation was discussed and examined with the object of finding some way to insure the protection of the customers of the Kellogg Company in the future as they had been protected in the past. Legal advice was again sought and it appeared that the minority stockholders of the Kellogg Company could secure legal redress and by so doing could insure the protection of the customers of the Kellogg Company, and the fulfilling of its obligations to the independent telephone business.

On May 19, 1903, Mr. Kempster B. Miller and Mr. F. J. Dommerque, of the Kellogg Company, were for the first time made acquainted with the situation and, with Mr. Dunbar, decided to bring suit against Mr. DeWolf, Mr. Barton, Mr. Fish, the American Telephone and Telegraph Company and the Western Electric Company for the recovery by Mr. Kellogg of his stock and to restrain the Bell interests from disposing of the stock until it could be returned to its rightful owner and from voting said stock to control or influence the management of the Kellogg Company or from influencing in any manner the management of said company, or from interfering with any of the patent suits pending against the Kellogg Company and its customers.

The suit was brought in the Circuit Court of the State of Illinois on Friday, June 5, 1903, by Henry S. Robbins, attorney for the minority stockholders, and on that day Judge Tuley of that court granted a preliminary injunction to the above effect. Mr. W. W. Dean, of the Kellogg Company, and other minority stockholders joined in the suit.

The suit brought by the minority stockholders of the Kellogg Company is not only in the interest of these stockholders, but, it is stated, is primarily in the interest of the customers of the Kellogg Company. The minority stockholders are confident in the successful issue of the legal steps which they have taken, as thus detailed.

Power Plant for the Philadelphia Subway.

One of the largest contracts for steam turbine and electrical power machinery recorded has just been closed by Westinghouse, Church, Kerr & Co., with the Philadelphia Rapid Transit Company, covering 15,000-kw of steam turbine and approximately 50,000-kw of electrical generating and converting machinery, for the new rapid transit subway and elevated system, now under construction in Philadelphia. The most interesting feature of the equipment to be installed, is that steam turbines are to be used exclusively for power generation in the central station now under construction. There will be three turbines, each of 5,000-kw normal capacity, which will be of the type now being built by the Westinghouse Machine Company for large powers. The turbines will be direct connected to Westinghouse 3-phase, 25-cycle, generators, and the units will run at 750 r.p.m. with 175 lbs. of steam, 27½" vacuum and possibly 100° to 150° of superheat. The three units will operate in multiple upon a common bus bar, and power will be distributed directly at a nominal potential of 13,000 volts from the station without the use of any intermediate transformers. For this purpose, the generators are wound for high potential.

The new power station is located upon the Delaware River, near the foot of Green street, and is laid out for an ultimate capacity of 50,000-kw, it being the idea of the designers to concentrate at this point the entire power generating equipment at present distributed among a number of smaller stations. The location of the new station upon the river bank secures excellent coaling facilities and an inexhaustible supply of water for condensing purposes. The present equipment will furnish power for the subway, and some reserve power for the surface traction system pending the execution of proposed plans for centralizing the entire power system.

The contract also comprises a large amount of transforming and converting machinery, to be installed in the several sub-stations, which will be built at various points in the district covered by the transit system. This machinery will be used for converting the high tension alternating current received from the power station into low potential direct current for use directly upon the third rail of the traction system. The first installation will comprise fourteen 1,000-kw and two 500-kw rotary converters. Each of the 1,000-kw rotaries will be furnished with three 375-kw step-down transformers, and each of the 500-kw rotaries with three 175-kw transformers of similar design. The electrical equipment will be built by the Westinghouse Electric and Manufacturing Company.

The new rapid transit system, now under construction, will cover the entire business district of Philadelphia, and includes a two and four track subway about 1¼ miles in length, extending from the Delaware River along Market street, to a point near Twenty-third Street, a short distance from the Schuylkill River. At Broad Street an appropriate central terminal station will be erected. The enterprise is one of the most important in the history of American railway development and the introduction of the steam turbine in such large sizes is particularly impressive by reason of the confidence shown in this comparatively new type of prime mover.

Ventilating Equipment for a Turkish Cruiser.

The recent disturbances in the Orient have directed much attention to the fighting resources of the Turkish Government. While the Turkish army appears to be courageous and fairly well equipped and drilled, it is a matter of common knowledge that the Turkish navy is practically non-existent, the few vessels in commission being old and out of repair. However, the Sultan is taking active steps to remedy this deficiency, and Messrs. Wm. Cramp & Sons, of Philadelphia, are now building for the Ottoman empire a large cruiser, to be named the *Medjidia*. This vessel will embody the latest improvements in naval construction, and will be an effective fighting machine in every way. One feature which has been looked after with particular care is the ventilation, which is of very great importance in a vessel serving in tropical or sub-tropical waters. Nine electrically-driven centrifugal fans are provided to ventilate the hull of the *Medjidia*. Fan No. 1 is a 40-in. steel-plate "exhauster," which will supply air above the protected deck, forward, while No. 2 of the same size will supply air below the protected deck forward. Fan No. 3 is an exact duplicate of fan No. 1 and will supply air between frames 65 and 66 aft. No. 4, of the same size, will furnish air aft of frame 66. No. 5, which is a 50-in. steel-plate "exhauster," will supply air to the dynamo and evaporating rooms. No. 6, a "Monogram exhauster," having a cast-iron housing, will supply air to the crew's quarters between frames 10 and 24. This fan is bolted to the ceiling and is driven by an electric motor supported on the side of the fan. Fan No. 7, which furnishes air to the crew's quarters between frames 24 and 34, is similar to fan No. 2. Fan No. 8 for the crew's quarters between frames 34 and 35, is a duplicate of fan No. 6, and fan No. 9, of the same size and character, furnishes air to the officers' quarters between frames 55 and 83. The 40-in. fans are capable of supplying 4,260 cubic ft. of air at 1 ounce of pressure when running at 822 r.p.m., and 1½ ounces when running at 1,010 revolutions. The 50-in. fan will supply 3,690 cubic ft. at 1 ounce pressure at 660 revolutions, and 1½ ounces at 808 revolutions. The four "Monogram" fans can supply 2,110 cubic ft. of air at 1 ounce pressure running at 822 r.p.m., or at 1½ ounces when running at 1,030 r.p.m. The entire ventilating equipment above described was furnished by the B. F. Sturtevant Co., of Boston.

Efficiency Tests of Tangential Water-Wheels Under 1912 ft. Effective Head.

Recent development in hydraulic practice on the Pacific coast has been toward the utilization of higher heads. In the minds of a number of engineers the question has arisen as to the wisdom of developing these high heads, utilizing the totality of fall in one station, as against dividing the fall up and passing the water through two or more stations in series, in this way utilizing the same water under lower heads in two or more power plants. The Edison Electric Company, of Los Angeles, Cal., had this problem to consider when it was proposed by them to install their new power plant, which has been known as Mill Creek No. 3, it being located in the Mill Creek Canyon near Redlands, Cal., the effective head on this plant being 1,912 ft. After carefully considering the matter, the Edison Company decided that it would be better engineering to utilize the total available head in one power station. They also concluded that, as they had several other power plants to build, this would be an excellent opportunity to test the relative merits of the different water wheels on the market.

The plant to be installed by them was to consist of four water wheel generating units of 750 kw each, designed for a 25 per cent. overload, at a turning speed of 430 r.p.m. They therefore decided to install at first but two units, the rest of the plant to be placed with the engineering firm furnishing the most efficient and satisfactory wheel unit. Accordingly they placed two orders, that for the second unit being placed with the Abner Doble Company, San Francisco, makers of the "Ellipsoidal Tangential Water Wheel"; at the same time taking an option from each firm for two additional wheel units under certain agreements.

The initial wheel units have been installed and tested, and have been in operation for several months, and it is interesting to note that, based on the results secured the Power Company has exercised its option, placing the order for the rest of the wheel units with the Abner Doble Company on account of the high efficiency over a wide range of load shown by its wheel, its capacity to carry a very heavy overload, and the maintenance of this high efficiency over a wide range of load. At loads from one-half load to over 25 per cent. overload the Doble wheel showed an efficiency on the preliminary tests of from 80 per cent. to 84 per cent. The generators in this plant were furnished by the General Electric Company.

This installation is of value in confirming the wisdom of the Power Company in utilizing its total head in a single station, as against dividing it up over several stations, as has been carried out by several of the other power companies. The nozzle used on this machine is of the Doble patented needle regulating type, which gives an excellent efficiency curve with variable load, the water consumption of the unit being almost strictly proportional to the power output of the generator.

Another important point demonstrated by this installation is that the efficiency to be secured under these very high heads is exceedingly favorable, clearly demonstrating that it is better engineering to utilize the total available power value in one station than to divide it up into two or more, excepting in most exceptional cases, where other conditions may exist, such as for instance excessive length of pipe line or reservoir and storage facilities. These tests make a very interesting comparison with the work of one of the famous Swiss builders in the Vouvry Plant, where the efficiency secured was 56 per cent.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was a good demand for time money for the long dates and considerable business was done, the lenders being largely banks and trust companies. The closing rates were 4 per cent. for 60 days, and 4½ to 6 per cent. for 90 days to seven and eight months. The stock market, after a violent fall in values, rallied materially on short covering, support from large interests and some further buying for long account. While the entire market felt the weight of an early selling pressure, the heaviest declines were in stocks which were attacked in force by the bear operators. Among the latter were Brooklyn Rapid Transit and Amalgamated Copper. The later improvement, however, extended throughout the whole list, and was especially pronounced in Amalgamated Copper. There was some activity in General Electric, which became very strong after the improvement commenced. The other industrials were not particularly prominent. General Electric made a net gain of 3¼ points, the closing price being 180½, which was 1 point below the highest of the week, the lowest quotation being 172½. The latter figure also represents the lowest quotation of the year. Westinghouse common touched 178 as the lowest point and 196 the highest, closing at 195, this being a gain of 13 points, the lowest figure of this week also being the lowest figure of the year. Westinghouse rights closed at 2¼, being ¾ of a point lower than the last quotation. Brooklyn Rapid Transit closed at 58½, a gain of 1 point, the lowest figure of the week and of the year being 54. Metropolitan Street Railway made a net gain of ¼ point, closing at 127¾, after touching 121½, which was also the lowest recorded figure of the year. Western Union made a net gain of 1¾, the closing quotation being 85½. American District Telegraph dropped to 26½, thereby losing 3½ points net. The following are closing quotations of June 16:

NEW YORK.

	June 9.	June 16		June 9.	June 16
American Tel. & Cable	75	77⅛	General Electric	175	177½
American Tel. & Tel.	140	142	Hudson River Tel.	..	..
American Dist. Tel	25	27	Metropolitan St. Ry.	122⅝	124⅛
Brooklyn Rapid Transit	56⅜	56⅝	N. E. Elec. Veh. Trus.	..	⅜
Commercial Cable.	..	..	N. Y. & N. J. Tel.	..	..
Electric Boat	20	18	N. Y. E. V. T. Co.	5⅛	5¾
Electric Boat pfd.	38	37	Tel. & Tel. Co. Am	..	..
Electric Lead Reduction.	1¼	1¼	Western Union Tel.	83½	85
Electric Vehicle	6⅛	7	Westinghouse com.	178	189
Electric Vehicle pfd.	12½	13⅛	Westinghouse pfd.	175	..

BOSTON.

	June 9.	June 16		June 9.	June 16
American Tel. & Tel	145¾	143	Western Tel. & Tel. pfd.	91	92
Cumberland Telephone	..	..	Mexican Telephone	1⅝	1¾
Edison Elec. Illum.	251	246	New England Telephone	133*	125
General Electric	175	179	Westinghouse	..	..
Western Tel. & Tel	13	13	Westinghouse pfd.	..	..

PHILADELPHIA.

	June 9.	June 16		June 9.	June 16
American Railways	..	..	Phila. Traction	96½	96½
Elec. Storage Battery	63	..	Phila. Electric	6⅛	6⅜
Elec. Storage Battery pfd.	..	..	Pa. Electric Vehicle	..	..
Elec. Co. of America.	8⅛	8¾	Pa. Electric Vehicle pfd	..	..

CHICAGO.

	June 9	June 16		June 9.	June 16
Central Union Tel.	..	..	National Carbon pfd.	94	94
Chicago Edison	154	154	Northwest Elev. com.	..	..
Chicago City Ry.	190	190	Union Traction	3⅛	3
Chicago Tel. Co	135½	..	Union Traction pfd.	30	30
National Carbon	23¾	23¾			

*Asked.

DIVIDENDS.—The Western Union executive committee has recommended the declaration of the regular quarterly dividend of 1¼ per cent. Manhattan Elevated directors have declared a quarterly dividend of 1½ per cent., payable July 1. The Otis Elevator Company has declared the regular quarterly dividend of 1½ per cent. on the preferred stock. U. C. I. Company, Philadelphia, has declared the regular quarterly dividend of $1 per share, payable July 15. The directors of the American Telephone and Telegraph Company have declared a regular quarterly dividend of 1½ per cent. and ¾ per cent. extra, payable July 15. The directors of the Chicago Telephone have declared the quarterly dividend of 2½ per cent., payable June 30, to stockholders of record on June 25. The United Traction & Electric Company of New Jersey have declared the regular quarterly dividend of 1¼ per cent., payable July 1. Directors of the Rochester Passenger Railway have declared a dividend of 1¼ per cent. on the preferred stock, payable July 1. The West Philadelphia Passenger Railway Company have declared a dividend of $5 per share, payable July 1. The Union Passenger Railway Company, of Philadelphia, have declared a dividend of $4.75, payable July 1. Twin City Rapid Transit directors have declared the regular quarterly dividend of 1¾ per cent. on the preferred stock payable July 1. A dividend rental of $2 per share will be paid to the holders of the preferred stock of the West End Street Railway Co. July 1.

ST. LOUIS UNITED RAILWAYS.—At a special stockholders' meeting of the United Railways Company the proposition to guarantee the proposed issue by the St. Louis Transit Company of $20,000,000 refunding and improvement bonds was almost unanimously carried. Three-fourths of the stock was voted, and only ninety shares voted against it. The financial plan involved looks into the future of the properties, and places the transit system in an unusually strong position. It is not likely that all the bonds will be issued, but it was deemed wise by the management to make ample provision for contingencies which may arise. The application of the $20,000,000 in bonds to be issued by the St. Louis Transit Company is as follows: During the year 1903:

Payment of the directors' loan and other indebtedness of the company $2,995,425
Improvements, betterments, etc., on the property of the United Railways of St. Louis, approximately..... 2,222,600
During years 1904 and 1905:
Collateral trust notes (due November 1, 1904)..... $5,776,000
Improvements, betterments, ets., on the property of the United Railways Company of St. Louis, approximately.. 2,280,000

The balance of the bonds will remain in the treasury of the company for future additions, acquisitions, betterments and improvements.

CHICAGO CITY RAILWAY COMPANY.—The terms on which the Chicago City Railway Company will agree to waive its claims under the so-called ninety-nine-year act have been reported by the subcommittee on franchises to the council committee on local transportation. The railway company declares, however, that there can be no waiver unless full remuneration for its tangible property be assured by contract, such payment to be based upon an impartial appraisement of the property at the termination of the new grant. The coincident proposition unalterably linked with the above is that if the municipality does not purchase, license may be granted to a new company to purchase at the same figure. Furthermore, the proposed contract specifies that in case the municipality neither purchases of itself nor licenses another corporation to purchase, "it will make a new grant to the company upon terms then to be agreed upon, it being understood that the then fair cash value of the tangible property comprising the street railway system of the company, and reasonably required for its operation (exclusive of any earning power or franchise value) shall be the basis of a new grant."

ELECTRIC STORAGE BATTERY.—Stock of the Electric Storage Battery Company to the amount of $15,795,700, all common, has been added to the trading list of the New York Stock Exchange. Its stock has been largely dealt in on the Philadelphia Exchange and on the local curb market. It is controlled by the Whitney-Ryan-Widener group of capitalists. In the application there is given a list of companies, eleven in number, whose patents are controlled by the Storage Battery Company. The total net earnings for the year ended December 31, 1902, according to the report, were $1,113,199, from which were deducted dividends of $812,427. It is stated that there is an undivided surplus of $2,323,354. The company estimates the value of its patents and franchises at $13,523,796. It has a total of quick assets of $2,147,467.

LOUISVILLE RAILWAY REORGANIZATION.—The directors of the Louisville Railway Company have agreed on a plan of reorganization, thus setting aside the differences between the common and preferred stockholders which threatened to terminate in litigation over the future policy of the company. The plan agreed upon is to increase the capitalization from $12,000,000 to $21,299,300. This new capitalization will be placed in the hands of a holding company to be chartered under New Jersey laws. The holding company will have $12,000,000 common stock, $2,500,000 preferred stock and $6,799,300 bonded indebtedness. The plan provides for paying for $3,000,000 worth of improvements and the purchase of $2,500,000 preferred and $3,500,000 common stock of the old company by issues of stock in the holding company.

NEW WESTINGHOUSE STOCK.—It is officially stated that the $4,500,000 of new stock offered to the stockholders of the Westinghouse Electric and Manufacturing Company has all been subscribed for. The willingness with which stockholders subscribed for the new stock is a source of gratification.

ELECTRIC LIGHTING IN NEW YORK.—There will be a hearing this week by the New York Aldermanic Committee on Water, Gas and Electricity on the application made by the Long Acre Electric Light and Power Company for a franchise, "right or privilege to lay, erect, construct and maintain suitable wires or other conductors, with the necessary poles, pipes, conduits, and appliances, in, on, over, across and under certain streets, avenues, public parks and places in the Borough of Manhattan." The application for a franchise was introduced in the board on May 19 by Alderman John T. McCall, "by request." The statement given is that the franchise is desired for the purpose of carrying on a general business of lighting, heating and supplying power. The territory in which the right is desired is between Fifth Avenue and the Hudson River, Thirty-third and Fifty-ninth Streets, and the term desired is twenty-five years, with permission of renewal at revaluation made by a committee of three. This is the company organized and to be run in the interests of the big theatrical managers for the purpose of supplying the theatres which they control. W. W. Walters, one of the managers of the Garrick Theatre, is quoted as saying that just as soon as the franchise was given the electric plant would be built at a probable cost of several million dollars. "We have not decided just where the plant is to be installed, and will not decide on anything until after we get the franchise. The Long Acre Electric Light and Power Company will not only be able to supply electric light at half the price the big electric light companies are charging, but at an even lower price. The plan of the company is to supply electric light to any place in need of it." The following are the officers of the company: President, William Harris; first vice-president, Frank McKee; second vice-president, Al Hayman; secretary, W. W. Walters, and treasurer, H. B. Harris.

THE MONTREAL LIGHT, HEAT AND POWER COMPANY'S second annual statement has been issued. It shows that the gross earnings of the company for the past year amounted to $1,937,560, and the net profits to $718,667. Out of the profits there have been declared four quarterly dividends of 1 per cent. each, amounting to $679,354, leaving a balance og $39,333, which has been placed to the credit of surplus account. The dividends paid show an increase over last year of $91,365, and, in addition, there was an increase in the interest on bonds and loans of $90,709. The company is now supplying all the gas and electricity used in the city of Montreal and suburbs, and the directors expect that the company will realize a considerable benefit from the economical operation of all the several companies, which comprise the Montreal Company, under one management. Owing to the break in the Chambly dam, the company suffered a loss in revenue, and an increased operating expense, estimated at $153,351 net earnings. During the year 17,806 incandescent lamps and motors, equivalent to 5,093 horse-power, were added to the circuits. At the meeting of the directors Mr. H. S. Holt was re-elected president, Hon. R. Forget, vice-president, and Mr. H. H. Henshaw, secretary-treasurer.

KINLOCH TELEPHONE, ST. LOUIS.—The report of the Kinloch Telephone Company of St. Louis, which has just been issued, shows an enormous increase in the amount of the telephone service in this city, and monthly net profits of over $11,000. The company's showing for the two fiscal years closed and the first four months of 1903 is given below:

Year ended December 31:

	1902.	1901.	Changes.
Gross	$472,137	$376,221	Inc. $95,916
Operation and maintenance	201,874	190,731	Inc. 11,143
Interest, taxes, etc.	157,226	135,832	Inc. 21,394
Net earnings	$113,037	$49,658	Inc. $63,379

First four months in 1903: Gross, $178,334; operating and maintenances, $77,729; interest, taxes and other charges, $56,080; net, $44,524.

BELL TELEPHONE STOCK INCREASE.—The directors of the American Telephone and Telegraph Company met this week and voted to issue $21,943,200 of new stock. On March 31 last the stockholders authorized an increase in the amount of capital stock from $150,000,000 to $250,000,000, the new stock to be issued from time to time as required for additions and improvements. Stockholders of record of June 30 will be entitled to subscribe to the new stock issue arranged for this week at par on the basis of one share of new stock for every five shares now held. There will be five payments as follows: September 22, 1903; November 21, 1903; January 22, 1904; March 22, 1904, and May 6, 1904. The new stock will not carry dividends until July, 1904, except in case of prepayment of the entire amount.

BULLOCK STOCK INCREASE.—The stockholders of the Bullock Electric Company, Cincinnati, O., have voted to increase the 6 per cent. preferred stock from $1,000,000 to $1,500,000. The money thus derived is to be used for the purpose of erecting more buildings and carrying a larger stock of material on hand.

Commercial Intelligence.

THE WEEK IN TRADE.—An improvement is noted in weather, crop and labor conditions, and the feeling prevails that damage from these sources has been overestimated. Seasonable quiet continues in wholesale business generally, and there is an improvement in tone as a result of the better crop outlook. Iron production is at the highest point ever recorded, but the old weakness in quotations has given way to a rather firmer tone, though advance buying is still the exception. Stocks of iron are not accumulating very much. Railroad earnings are good on the whole, though the western floods have curtailed the June gross receipts somewhat. May gross receipts show a gain of 12 per cent. as against a gain of 14.3 in April, but follow a gain of 9 per cent. in May, 1902, over 1901. The prediction that the winter wheat yield would be 485,000,000 bushels has been confirmed in the government report showing conditions still above the average and far above 1902. Spring wheat, though 2 per cent. smaller in area than last year, is in good condition and it is estimated that the crop will yield 300,000,000 bushels. The business failures for the week ending June 11, as reported by *Bradstreet's*, numbered 181 against 157 the week previous and 165 the corresponding week last year.

BATTERY FOR ST. LOUIS TRANSIT.—Mr. A. B. Du Pont, vice-president of the St. Louis Transit Company, has recently executed a contract with the Electric Storage Battery Company, of Philadelphia, manufacturer of the Chloride accumulator, for the installation of a 3,000-kw storage battery to be used in a rotary sub-station with rotaries having a capacity of 6,000 kw. The battery will regulate on the fluctuations and assist in caring for the morning and evening peaks. The sub-station is in the center of the city, and this installation is one of the extensions being made for the purpose of caring for the increase of traffic. It is interesting to note that this contract represents the largest individual installation of storage batteries in the world for railway service.

ELECTRICITY ON THE COMSTOCK.—It is stated that after a long series of vicissitudes, by the Fourth of July all the mines on the Comstock lode will be running again for the first time in fifteen years. By that time the lower levels of the Consolidated California and Virginia mine will be unwatered, and it is expected that good paying ore will be found on the lower levels. In nearly all the old mines electric hoists have been put in and the mines are all using electric power, which will greatly lessen the expenses of operating. It is now fifteen years since a small bonanza was found in Consolidated, California and Virginia which yielded $6,000,000.

BALL ENGINE ORDERS.—The Windsor Sugar Company, Windsor, Colo., will have an electric plant consisting of two engines of 150 hp direct-connected to Crocker-Wheeler generators. The Ball Engine Company, Erie, Pa., furnishes the engines, which are of the self-oiling type. The Longmont Beet Sugar Company, Longmont, Colo., will install an electric plant, consisting of three engines of 725 hp, direct-connected to Crocker-Wheeler generators. The Ball Engine Company furnishes the engines of the self-oiling type.

EQUIPMENT FOR STANDARD STEEL COMPANY.—The American Engine Company, of Bound Brook, N. J., with New York offices, Edwin S. Boyer, manager, White Building, has just been awarded a contract by the Standard Steel Company, of Burnham, Pa., for a 800-hp engine for direct connection to a Crocker-Wheeler generator of 600-kw capacity. The equipment is to be used for both light and power purposes at the Burnham plant.

SPRAGUE ELEVATORS FOR AUSTRALIA.—The Sprague Elevator Company, 52 Broadway, New York, has secured a contract for electric elevators to be installed in the new Adelaide Savings Bank Building, Adelaide, South Australia. The contract was obtained through Unbehaun & Johnstone of that city. The ventilating apparatus for the same building will be driven by a Western Electric motor.

GERMAN TELEPHONES FOR BOMBAY HOTEL.—The $2,000,000 hotel which J. N. Tata, the founder of the British Indian house of Tata & Co., New York offices, 88 Wall Street, is building in Bombay, is to be equipped with German telephones, our Teutonic rivals securing the contract on the points of both prices and delivery. Each of the 600 bedrooms of the hotel will have a telephone.

LIGHTNING ARRESTERS FOR CHINA.—Fearon, Daniel & Co., of China, 96 Wall Street, which concern purchases considerable quantities of electrical supplies, etc., for shipment to the Far East, has secured a substantial order for lightning arresters from the Shanghai Municipal Council for the electric lighting system of the foreign settlement.

COPPER WIRE FOR ENGLAND.—The John A. Roeblings' Sons Company, 117-119 Liberty Street, New York, is shipping considerable copper wire to England.

THE SWEDISH AMERICAN TELEPHONE COMPANY, West Jackson Boulevard, Chicago, has recently closed contracts with the following-named telephone companies for their complete equipment: The Rural Union Telephone Company, at Livermore, Iowa, with exchanges at Livermore, Humbolt, Bode, Harding, Rutland and Pioneer, Iowa; Dedham Telephone Company, Dedham, Iowa; People's Mutual Telephone Company, Latimer, Iowa; Golden Rod Telephone Company, Osceola, Neb.; M. L. Reynolds Telephone Company, Delton, Wis.; J. A. Murray, North Freedom, Wis.; Farmers' & Merchants' Telephone Company, Runnells, Iowa; Rowan Rural Telephone Company, Rowan, Iowa; Auburn Telephone Company, Auburn, Neb.; West Lawn Telephone Company, Leeton, Mo.; Interstate Telephone Company, Modale, Iowa; Peet & Co., Swea City, Iowa; Brown Supply Company, Coffeyville, Kan.; Farmers' Mutual Telephone Company, Hepburn, Iowa; Armstrong Telephone Company, Yatesboro, Pa.; Butternut Valley Telephone Company, New Berlin, N. Y.; D. H. Holt, Bronson, Kan.; Judson Milling Company, Judson, Ind.; Wilsonville Telephone Company, Stockport, Iowa; Epworth Rural Telephone Company, Cleghorn, Iowa; Arion Telephone Company, Arion, Iowa; Osmond Telephone Company, Osmond, Neb.; Potosi Telephone Company, Potosi, Mo.; Landesville Mutual Telephone Company, Landesville, Ind.; Kilbourne Telephone Company, Kilbourne, Wis.; Pierson Telephone Company, Pierson, Iowa; Rector Co-Operative Telephone Company, Rector, Ark.; La Fontaine Telephone Company, La Fontaine, Ind.; Orange Mutual Telephone Company, Orange, Ind.; Viborg & Centerpoint Telephone Company, Viborg, S. D.; Tracy Telephone Company, Bussey, Iowa; New Richmond Telephone Company, New Richmond, Ind.; Sharpesville Telephone Company, Sharpesville, Ind.; Lincoln Mutual Telephone Company, Stuart, Iowa; Cherokee Mill & Elevator Company, Cherokee, Kan.; Deer Creek Co-Operative Telephone Company, Deer Creek, Ind.; Camden Telephone Company, Camden, Ind.; Burrows Telephone Association, Burrows, Ind.; Seymour Telephone Company, Seymour, Ill.; Roseville Telephone Company, Roseville, Ill.; Teton Telephone Company, St. Anthony, Idaho; West Bend Telephone Company, West Bend, Iowa; Arlington Telephone Company, Arlington, Ind.; Citizens' Telephone Company, Murrayville, W. Va.; Prairie City Telephone Company, Prairie City, Iowa; Mitchellville Telephone Company, Mitchellville, Iowa; Bedford County Telephone Company. Bedford, Pa.

POWER IN CALIFORNIA.—Because of the increase in the consumption of power and the present and bright prospective demand for a continuity of service for the mines and smelters in the northern part of the State, the Northern California Power Company has inaugurated a plan for the improvement of its great power system, which when completed will give it the most flexible and one of the finest systems of electrical generation and transmission in California or the West. A large amount of machinery has arrived from the East for new generating plant. The new transmission line from the company's sub-station at Keswick to the Balaklala mines on Squaw Creek, now being surveyed, will be constructed with a view to permanency. It will have a potential equal to that of the main line from the present power plant, viz., 20,000 volts. It will parallel the railroad from Keswick to Copley, and will then lead across the lower foothills to a junction with the wagon road recently constructed from Kennet to the Balaklala and Shasta King mines by the Balaklala Mining Company and the Trinity Copper Company. It will be fifteen miles in length. In the perfection of its entire system, the Northern California Power Company will run several tying-in lines to connect either or both of its power plants with all branches of the entire system.

AUTOMATIC TELEPHONY IN NEW ENGLAND.—Mr. J. L. Putnam, the energetic general manager of the Clark Automatic Telephone Switchboard Company, of Providence, R. I., reports that the Automatic Telephone Construction Company, recently organized in that city for the purpose of erecting small town plants, is at present engaged in building an exchange at Hope Valley, R. I., where it proposes to install the Clark system. He also mentions that the Clark Company has recently furnished a 48-point plant for the Société Alsacienne de Constructions Mechaniques Company's works at Belfort, France. Among recent work at home is a 48-point Clark plant in the factory of the Eagle Lock Company, at Terryville, Conn., and a 30-point plant in the Boston Store at Providence, R. I.

WORK IN THE YOSEMITE.—The proposed Yosemite Valley Railway, it appears, will materialize in a short time. The company have received all the encouragement they could ask. They are just about ready to take steps preliminary to construction. The terminus at either end of the line has not been decided on yet. At the lower end it will probably be Merced or Modesto. The company owns valuable water sites along the river, an excellent one being in the park. If this cannot be utilized the one at McCabe's flat, a few miles above Bagby, will be the site of a big plant. One of the main features of the enterprise will be furnishing power to the mining industry. It will prove a boon to many localities where fuel is much higher than electric power would be.

ELECTRIC TRACTION FOR SAN LUIS POTOSI.—An electric traction system is to be constructed in San Luis Potosi, Mexico, by American interests. The Potosina Electric Company, which recently acquired the interests of the San Luis Electric Company, will build the road. Sanderson & Porter, 52 William Street, New York, act as consulting engineers for the company, which at present lights San Luis Potosi. Additional lighting equipment has been ordered from Westinghouse, Church, Kerr & Company, three 250-hp Westinghouse gas engines, to operate on the Loomis-Pettibone system having recently been ordered. There is a horse tramway—the Tranvias de San Luis Potosi—at present operating in that place. It is 13 miles in length.

COMBINATION IN AUSTRIA.—An electrical manufacturing consolidation scheme for Austria is said to include the Austrian Union Electricity Company (a promotion of the Union Company, of Berlin), the Austrian Schuckert Company, and the branch establishment of the Siemens & Halske Company. The prospect of the creation of more intimate relations between the external off-shoots of the Siemens & Halske Company and the Schuckert Company has already been foreshadowed in the official communications issued by the latter two companies in connection with their scheme of amalgamation, but no mention has previously been made of the inclusion of the Austrian Union Company in this direction.

MOTORS ON ERIE.—With regard to the work going on upon the Erie Canal, a telegram from Albany, of June 5, says: It is announced that a test of electric motor cars for hauling canal boats is to be made shortly on the Erie Canal near Schenectady. At the Schenectady works of the General Electric Company two cars are being built for this electric motor system, and the test is to be made with the consent of the State Superintendent of Public Works. Poles will be erected for a stretch of a mile and a half along the canal, and when the test is made the cables will be stretched from the towing-boat to the cars, which are to run on rails to be placed on the outer side of the towpath.

ALLIS-CHALMERS ENGINE SALES.—In a long list of Allis-Chalmers engine sales for May, 1903, the following are noted: Northwestern Elevated Railway Company, Chicago, Ill., 34-in. and 70-in. x 60-in. heavy duty, horizontal cross-compound direct-coupled Reynolds Corliss engine. Takata & Co., 15-in. x 36-in. heavy duty, horizontal direct-coupled Reynolds Corliss engine. St. Louis Exposition, 44-in. and 94-in. x 60-in. combined vertical and horizontal direct-coupled Reynolds Corliss engine. National Tube Company, Pittsburg, Pa., three vertical, triple-expansion pumping engines, fifteen million gallons capacity each.

THE NORTON COAL COMPANY, of Norton, Va., is opening new operations and adding coke ovens, for which extension to its plant it has recently purchased from the Westinghouse Electric & Manufacturing Company two additional generators with larry equipment, etc. This company already has in use two 100-kw, belted, 250-volt, Westinghouse generators, together with two Baldwin-Westinghouse mining locomotives, switchboard and other auxiliary apparatus, making a complete electrical installation for mine haulage purposes.

ELECTRICAL SUPPLIES IN UTAH.—The Inter-Mountain Electric Company, of Salt Lake City, Utah, has been organized to do all kinds of electrical work and sell all lines of electrical supplies. The new company is the old firm of the same name, of which Mr. S. F. Fenton was the sole proprietor, he now being president and manager of the new concern. The other officers are E. A. Tripp, vice-president; L. H. Farnsworth, treasurer, and G. C. Fenton, secretary and assistant manager.

ELECTRICAL SUGAR REFINERY FOR PORTO RICO.—A large sugar refinery is to be built in Porto Rico, which will be equipped with considerable electrical machinery. The capacity of the plant will be 1,000 tons per day. The power plant will be capable of developing 1,200 hp. The pumps will be driven by electric motors. The Smokeless Combustion Company, 1 Broadway, New York, will let the contracts for equipment.

STROMBERG-CARLSON TELEPHONE OUTFITS.—The Consolidated Telephone Company, of Gridley, Ill., has purchased a switchboard and equipment from the Stromberg-Carlson Telephone Manufacturing Company, of Chicago, Ill., and Rochester, N. Y., which has also recently sold switchboard and telephones to the Concord Telephone Company, Concord, Ill.

THE SAUQUOIT SILK MILLS, of Philadelphia, have recently purchased from the Westinghouse Electric & Manufacturing Company two 125-kw, three-phase, engine-type generators, and 300 ½-hp, three-phase induction motors, each of these motors to be direct-connected to a silk loom.

THE OTIS ELEVATOR COMPANY will next week remove its present offices in the Empire Building to more commodious premises in the Battery Place Building, where two complete floors—the fifth and sixth—have been secured.

'PHONO-WIRE FOR ENGLAND.—The Bridgeport (Conn.) Brass Company recently secured a contract for some 20 miles of 'phono wire for shipment to England, for street railway purposes.

General News.

THE TELEPHONE.

HARRISON, ARK.—The Reich Telephone Company has been incorporated here with a capital stock of $10,000. Mr. J. L. Reich is president.

TEXARKANA, ARK.—The Texarkana Telephone Company operates a 1,000-drop board and has 800 subscribers. The apparatus is American; 2 wire common battery. The company is now building toll lines. The rates are $36 and $24 per year. This is a fine system, having 16 miles of cable and all the wires in the downtown district underground. The company expects a large increase of subscribers.

CORONA, CAL.—The City Council has granted a twenty-five-year franchise to Henry A. Coit to operate a telephone system.

EUREKA, CAL.—It is stated that the Sunset Telephone & Telegraph Company is negotiating for the purchase of the Humboldt Telephone Company.

GREELEY, COL.—The Morgan County Independent Telephone Company was incorporated January, 1903, with $35,000 capital. The apparatus of Kellogg Switchboard Company is used—a 300-drop board. There are 275 subscribers and 47 miles of toll line. Besides this 80 miles more are being built and other connections made.

NEW BRITAIN, CONN.—The Farmington Valley Telephone Company has 150 subscribers at $12 and $15, and 30 miles of toll line.

WOODBURY, CONN.—The Woodbury Telephone Exchange furnishes telephone service to Southbury, Oxford and Roxbury as well as this place, the number of subscribers gradually increasing. A 100-drop board of Swedish American make furnishes service to 160 subscribers at $15 for residences and $20 for business houses.

SANFORD, FLA.—The Sanford Telephone Company has only been in operation six months and finds prospects very bright. It operates a 200-drop board and has 118 subscribers at $1.50 for residences and $2 for business houses. A line to De Land is contemplated, 21 miles in length.

COVINGTON, GA.—The Covington Telephone Company has a 200-drop board, 202 subscribers and has made an excellent showing in less than two years. It connects with ten farmers' lines and is steadily increasing. Rates are $1 for residences, $2 for business houses.

WAYCROSS, GA.—The Southern Bell Telephone & Telegraph Company will spend $15,000 in reconstructing the telephone exchange in this place. All of the old wires in the business section of the city are being taken down and cables substituted. New apparatus will be installed in the exchange.

PEKIN, ILL.—The Citizens' Telephone Company has increased its capital stock from $50,000 to $200,000.

JOSLIN, ILL.—The Crescent Telephone Company operates four switchboards of 100 drops each. It has 350 subscribers and 60 miles of toll line. Messages are 10 cents.

STEWARDSON, ILL.—The Stewardson Telephone Company operates a 100-drop board with 100 subscribers and 15 miles of toll line. The rates are $1, $1.25 and $1.50.

CHICAGO, ILL.—The Western Telephone & Telegraph Company has been incorporated with a capital stock of $2,500 by F. W. Pringle, H. Hallett Johnson and H. S. Pringle.

WAPELLA, ILL.—The Long Point Mutual Telephone Company has a switchboard capacity of 100 and 190 subscribers. There are 120 miles of toll line. Three companies are doing business in the same territory.

MT. OLIVE, ILL.—The Mt. Olive Telephone & Electric Company is at present engaged in installing its system—the Strowger. It has an automatic switchboard of 999 drops, and 100 subscribers. Operations will commence July 1.

IVESDALE, ILL.—The Farmers Mutual Telephone Association has a 40-drop board; 70 subscribers and 40 miles of line. An increase of 200 subscribers is expected within the year. Connection is made with other towns and cities at a small rate.

STREATOR, ILL.—The Streator Independent Telephone Company will extend and improve its lines at an expenditure of about $30,000. A toll line will be built to Ransom where connections will be secured with 150 farmers' instruments.

ROCKFORD, ILL.—The Rockford Home Telephone Company has a switchboard with 1,600 lines installed, 4,000 being the ultimate capacity. It has 1,700 subscribers and growth has been rapid and demand greater than can be cared for. Toll lines are projected.

BANVILLE, ILL.—The Vermillion County Telephone Company has completed plans for improvements to its system, which will cost in the aggregate about $61,000. The present capacity of the exchange is about 2,000 telephones, but this will be increased to about 8,000.

RUSHVILLE, ILL.—The Grange Telephone Company uses "Standard" telephones; has a 30-drop board and 240 subscribers. The rates are from $8 to $15 per year and 20 cents for toll messages. Another, a mutual telephone company has been incorporated in Rushville, but is not yet in operation.

DAHLGREN, ILL.—The Dahlgren Peoples' Telephone Company operates Stromberg-Carlson apparatus and has a 25-drop switchboard. It has 150 subscribers. There are 200 miles of toll line and the rates are 10 cents per message. Recent growth has been rapid and an increase in plant is projected in the near future.

PEORIA, ILL.—The annual meeting of the stockholders of the Citizens' Telephone Company was held here recently. The company, which started last February, now has 850 telephones. The stock was increased to $200,000. Directors were elected and they will meet to elect officers. It is probable that the present officers will be re-elected.

GALESBURG, ILL.—We are informed by the manager of the Galesburg Union Telephone Company that business is increasing with remarkable rapidity. He operates apparatus of the Sterling Electric Company, has a 1,350-drop board and 1,950 subscribers. The company has 50 miles of toll line of its own and hundreds in co-operation. Rates are $1 to $2.50 per month. Farmers' connections are being made daily.

CHICAGO, ILL.—Two wireless telegraph stations have been established at Chicago and Milwaukee. These have been erected by the Marconi Company, and will probably be used for the transmission of ordinary paid messages. A station will be built at South Haven within a short time, and it is said that the system will be gradually expanded until every port on the great lakes has a station. It is also intended to install Marconi instruments on some of the larger lake vessels.

EL PASO, ILL.—The El Paso Telephone Company has a switchboard capacity of 300 series; 50 bridging drops for rural lines on the Stromberg-Carlson system. It has 255 city subscribers, 320 rural party lines, built by the farmers themselves to the city limits, whence they can run into the office. The farmers therefore own the telephones and pay $3 per year switching fees. The company has doubled its growth in eight months and claims to have the largest exchange in the world for the number of inhabitants within the city limits.

CHICAGO, ILL.—Charges have been made before the council committee on gas, oil and electric light that the ordinance anxiously sought by the United Telegraph, Telephone and Electric Company, now operating in Hyde Park, but seeking to extend its lines to all portions of the city, is a measure from which the Chicago Telephone Company hopes to benefit when its present franchise expires in 1909. The ordinance giving the company the right to use all of the streets of the city for the system, bases the telephone rates on the following schedule: Direct lines, 600 calls, $60; excess 5c.; 1,200 calls, $88; excess 4c.; 1,800 calls, $109, excess, 4c.; 2,100 calls, $118, excess 3c. Two-party lines: 600 calls, $44, excess 5c.; 1,200 calls, $70, excess 4c.; 1,500 calls, $80, excess, 5c. Four-party lines: 600 calls, $28, excess 5c.; 1,200 calls, $56, excess 4c.; 1,500 calls, $68, excess 3c.

WINCHESTER, IND.—The Pleasant Hill Telephone Company has just been organized in this place.

FRENCH LICK, IND.—The Star Telephone Company has increased its capital stock from $2,000 to $15,000.

WARSAW, IND.—The Commercial Telephone Company has increased its capital stock from $30,000 to $50,000.

BUNKER HILL, IND.—The Miami County Telephone Company operates a 150-drop board and has 150 subscribers. The outlook is good.

PARKER CITY, IND.—The Parker Telephone Company operates a 200-drop board, has 250 subscribers and 18 miles of toll line. Extensions are projected.

LUTHER, IND.—The Luther Telephone Company operates a 300-drop board and has over 200 subscribers. Extensions are projected, and the outlook is very bright.

BROWNSBURG, IND.—The Brownsburg Telephone Company operates a 200-drop board, and has 117 subscribers at $1 per month. A large increase in the system is in contemplation.

ROANOKE, IND.—The Roanoke Telephone Company operates a 99-drop board and has 60 subscribers. The rates are $1, $1.50 and $1.25 for residences, business houses and farmers, respectively.

FRENCH LICK, IND.—The Star Telephone Company, of French Lick, has increased its capital stock from $2,000 to $15,000. The company will make improvements and extend the lines to meet the demands for service.

MONROEVILLE, IND.—The Monroeville Home Telephone Company uses Stromberg-Carlson apparatus, has a 100-drop board and 200 subscribers. The rates are $1 and $2 per month. The company is building rural lines.

MOHAWK, IND.—The Mohawk Telephone Company uses apparatus of the Modern Telephone Company and has 170 subscribers. There are rural and party lines at $1 per month. This is a farmers' mutual company.

PORTLAND, IND.—The Home Telephone Company operates an American express board with 450 subscribers. An increase of 100 telephones is projected. The rates are $2 and $1 for business houses and dwellings respectively.

SARATOGA, IND.—The Branch Independent Telephone Company has a 30-drop board of Stromberg-Carlson make. There are 26 subscribers and 22 miles of toll line. The rate is $1 per month. The situation and outlook are good.

DUNLAPS, IND.—The Dunlaps Telephone Company operates a 25-drop board and has 100 subscribers. There are 10 miles of toll line. The rates are $12 per annum. A large increase in the number of telephones is expected in the near future.

LEBANON, IND.—The Lebanon Telephone Company operates a 600-drop "Sterling" switchboard and has 700 subscribers at $1.25 and $1.75 and $1.00 for party-line service. The company will increase the number from 1,200 to 1,500. It has 50 miles of toll line.

WEST SONORA, IND.—The Deer Creek Co-operative Telephone Company has filed articles of incorporation with the Secretary of State. The capital stock is $3,000. The incorporators are A. A. Cook, A. A. Newer, Samuel Mitchell, Perry Johnson and James T. Zartman.

WHITESTOWN, IND.—The Whitestown Citizens Telephone Company operates a 50-drop board and has 149 subscribers, which number will probably be doubled within another year. The system is co-operative, each owner paying his share of all expenses. There are no other charges.

PORTLAND, IND.—The City Council has granted a franchise to the Hoosier Telephone Company, an organization of local men, with $100,000 capital.

The company will put in a telephone plant here to compete with the Home Telephone Company, which now has a monopoly of the business.

CAMDEN, IND.—Representatives of all the telephone exchanges in Carroll County, at a meeting in this city, decided to encourage connection with county seat exchanges, but bound themselves not to pay a cent for such connection. This will apply to Delphi, Logansport and Frankfort.

WINCHESTER, IND.—The Winchester Telephone Company, operating a plant here for the past five years and the Eastern Indiana Telephone Company with 200 miles of line in Randolph County, have consolidated and will reincorporate under the name of Winchester Telephone Company.

CHERUBUSCO, IND.—The Geigar Telephone Company is now putting up a new building and will buy a new board, cable, etc., as soon as it is completed. It now has a 300-drop board with 200 city and 150 farmer subscribers. These will be probably doubled later. The rates are $18 for business, $12 for private houses.

LEBANON, IND.—The New Long Distance Company, of Indianapolis, has bought a controlling interest in the Lebanon Telephone Company. This is thought to be the initial step toward securing the controlling interest in all the county-seat telephone plants through which the Long Distance Company's line runs.

COVINGTON, IND.—The Covington & Coal Creek Co-operative Telephone Company uses apparatus of the Eureka Electric Company, and has a 100-drop board with 23 subscribers and 25 miles of toll line. There are only farmer subscribers at present, but a material increase in number will probably soon occur. Rates are 70 cents.

NEW ALBANY, IND.—The Home Telephone Company's system has been connected at Fredericksburg with an independent long-distance telephone which has been extended from Martinsburg. The company's lines are being extended in every direction and in a short time many farm houses in southern Indiana will be connected with the city exchanges.

MODOC, IND.—The Modoc Telephone Company uses Kokomo apparatus, has a 100-drop board and 125 subscribers. There are 37 miles of toll line and 350 miles of wire, most of which is of recent growth. The company is about to install a switchboard at Economy, Ind.; and branch lines will be built from there. Rates are $1.00 for private and $1.50 for business telephones.

ROCKPORT, IND.—The Luce and Ohio Township Telephone Company operates a 900-drop board and has 700 subscribers. Rates are $1 and $2 for dwellings and business houses respectively. A plant in Warwick County is projected. The company cannot build fast enough to supply the demand and has already declared a dividend of 6 per cent., besides using receipts for construction work.

GREENFIELD, IND.—The Allentown Telephone Company, of Hancock, has filed articles of incorporation with the Secretary of State. The capital stock is $160, divided into sixteen shares of $10 each. The purpose is to build and operate a rural telephone system, the service to be free to the subscribers. Daniel W. Lonebalk, W. W. Crider, J. W. Bash, Joe A. Smith, R. F. Cook and others are incorporators.

RICHMOND, IND.—The controlling interest in the Richmond Home Telephone Company has been purchased by Colonel Orr and L. M. Flesh, capitalists of Piqua, Ohio, with Edward L. Gates, banker at Richmond. The Home Company is one of the most successful independent companies in the State. The new owners state that additional equipment will be installed and the lines extended to meet the demands.

BEDFORD, IND.—The Bedford Home Telephone Company operates a 480-drop board; with an ultimate capacity of 3,200—Stromberg-Carlson equipment. There are 200 subscribers. This plant was opened for business June 1, 1903, and expects to number 300 subscribers before the month closes. Toll connections are being made with the farmers' local lines in Lawrence County, connecting over 700 subscribers and a long distance line to Seymour, Ind., where still further connections will be made.

WABASH, IND.—The franchise of the Central Union Telephone Company in this city has expired by limitation and the company has not as yet made application for renewal. The council is urged to take steps to have the company's property removed from the streets or to secure more favorable terms for a renewal of the franchise. The stockholders of the Home Telephone Company of this city, which has practically the bulk of the business, and who are active and influential business men are said to be opposing the granting of a new franchise to the Central Union.

PLAINVILLE, IND.—Work has begun on the telephone line from this city to Washington where it will connect with the Home Company's line. A complete system will be put in, connecting Washington, Plainville, Cornettsville, Epsom, Elnora, Sandborn, Bicknell, Roglesville, Newberry and Edwardsport. The rural district will have access to the system throughout the county and it will also give the patrons access to direct connection with Washington, Vincennes, Terre Haute, Indianapolis and the many other cities. W. H. Bunch is president of the new system and B. J. Millis, secretary.

IOWA FALLS, IA.—The Central Iowa Telephone Company has increased its capital stock to $200,000.

BURLINGTON, IA.—The Modern Telephone Company will establish an automatic exchange in this city.

DES MOINES, IA.—The Slater Mutual Telephone Company has been incorporated with a capital stock of $10,000.

FLANDREAU, IA.—The Rural Reciprocal Telephone Company has been incorporated with a capital stock of $10,000.

BOXHOLM, IA.—The Boxholm Telephone Company intends to extend its system, and will also buy a 100-drop switchboard.

BONDURANT, IA.—The Farmers' Mutual Telephone Company has been organized at this place, the capital stock being $20,000.

NICHOLS, IA.—The Nichols Mutual Telephone Company has been incorporated with a capital stock of $2,000. Mr. John Nichols is president.

CRESTON, IA.—The Creston Mutual Telephone Company has increased its capital stock to $100,000, and will expend about $12,000 in improvements and additions to its system.

MUSCATINE, IA.—The Mississippi Valley Telephone Company is preparing to put in a new switchboard, string new cables and make a general overhauling of its system in this city.

COLLINS, IA.—The Collins Telephone Company operates a 200-drop board and has 162 subscribers. It has 50 miles of toll line and expects to add 15 more soon. The rates are $1 per month.

WOOLSTOCK, IA.—The Woolstock Telephone Company operates a 50-drop Kellogg switchboard and has 190 subscribers. It has 85 rural connections at $1 per month. Extensions are projected.

HAWARDEN, IA.—The Hawarden Telephone Exchange has been sold to W. J. Van Allen, of Epworth, Ia., and J. A. Lattner, of Worthing, Ia. New lines will be constructed throughout the county.

GRIMES, IA.—The Farm Mutual Telephone Company has installed Stromberg-Carlson apparatus and a 100-drop board. It has 350 subscribers. The company has 115 miles of farm lines all built in the past year.

MODALE, IA.—The Interstate Telephone Company will establish an exchange in this city and otherwise improve its system. It will probably extend the line to Little Sioux and possibly up the Soldier Valley in the near future.

IOWA CITY, IA.—The Sharon Farmers Mutual Telephone Company operates a 25-drop board and has 150 members. Membership costs $30. The company has connection with long distance telephones to Muscatine, Cedar Rapids and other places.

MILFORD, IA.—The Midland Telephone Company which operates Kellogg apparatus has a 100-drop board and 140 subscribers; with 15 miles of toll and 75 of rural lines. Rates are $1 per year. The company is building to Arnolds Park and Spirit Lake.

FOREST CITY, IA.—The Great Northern Telephone Company has four switchboards of 350-drop capacity and 350 subscribers. There are 30 miles of toll line, and one exchange has been put in. Extensions are projected. The rates are: Rural lines, $1.25; business, $2; dwellings, $1.

PRAIRIE CITY, IA.—The Farmers and Merchants Telephone Company operates Swedish-American apparatus; has a 200-drop board and 350 subscribers at $1.50 and $1.00 per month. Prospects are good for 200 more. There are 24 miles of toll line. The company was formed one year ago.

FAIRMONT, IA.—The Consolidated Telephone Company operates a 600-drop board and has 600 subscribers. There are 100 miles of toll line, and a new one to Fairview is projected. Business rates are $30; residences $20. The company operates in five counties and has a total of 2,500 subscribers.

RED OAK, IA.—Mr. J. F. Miller, manager of the Montgomery County Telephone Company gives us some interesting notes of that very prosperous concern. He operates Stromberg-Carlson apparatus, having a 500-drop board. Another 100-section is to be installed. There are 425 subscribers, paying $1 per month for residence instruments and $2 per month for business houses. The company commenced business January, 1903, and now has 200 more subscribers in sight. Many improvements are projected.

CLAREMORE, I. T.—The Claremore Telephone Company, owned by Mr. J. G. Rucker, operates a 150-drop board, has 115 subscribers and 95 miles of toll line. The rates are $1.50 for residences and $2 for business houses. The outlook is very favorable.

ALTOONA, KAN.—The Altoona Co-operative Telephone Company uses Eureka apparatus and has a 50-drop board with 65 subscribers and 20 miles of toll line.

CEDAR VALE, KAN.—The Dosbaugh Telephone Company has a 100-drop board at Cedar Vale with 100 subscribers; a 250-drop board at Sedan, with 220 subscribers; 150 at Caney with 115 subscribers and 100 at Peru with 50 subscribers. The apparatus used is Kellogg, Ericsson and Standard. Rates are $1 for residences, $2 for business houses. There are 130 miles of toll line. New buildings are being constructed. Growth has been rapid and in view of the gas and oil development in the section a still greater increase is expected.

BARBOURVILLE, KY.—The Hyden Telephone Company has been organized here to build a line from Manchester to Hyden.

INDEPENDENCE, KY.—Sealed bids will be received by the Kenton Fiscal Court for a local telephone franchise in this city. Charles Durin and Thomas Dunn constitute the committee.

VALLEY CITY, MD.—The Valley City Telephone Exchange operates a Kellogg switchboard of 600 drops, has 430 subscribers and 165 miles of toll line. About 100 miles of farmers' lines is projected. The rates are $2 and each. Business is brisk for almost every farmer wants to subscribe.

HAVERHILL, MASS.—The People's Telephone Company uses Couch & Seeley apparatus, has a 300-drop board and 600 subscribers. Growth has been satisfactory.

NEW BEDFORD, MASS.—The Automatic Telephone Company, of New Bedford, has a switchboard capacity of 10,000 drops, 750 subscribers and 14 miles of toll line. It has increased steadily, having added three switchboards within a month. Toll lines to surrounding towns are projected, and general building up of the system in southeast Massachusetts, where new subscribers are coming in daily.

SAGINAW, MICH.—The Michigan Bell Telephone Company is preparing to make extensive improvements in this city.

SAGINAW, MICH.—The Valley Telephone Company is building new lines to Frankenmuth, Fairgrove, Reese and Vassar.

MENOMINEE, MICH.—The American Electric Telephone Company will ask for a franchise for a telephone exchange here and at Marinette.

LIBERTY, MICH.—The Liberty Telephone Association has a 12-drop board

and 175 subscribers. There are 12 miles of toll line and 40 miles more will be built.

MARION, MICH.—The Marion Telephone Company has a 70-drop board of the Eureka Electric Company's make and 30 subscribers. Ten miles of toll line are projected.

ROCKLAND, MICH.—The Ontonagon County Telephone Company has a switchboard capacity of 200 drops and 140 subscribers. The increase has been good for two years.

HOWELL, MICH.—The Livingstone Home Telephone Company employs Eureka and other apparatus, has a 300-drop board and 268 subscribers. It has 140 miles of toll line, its rates being $24 and $12 for business houses and dwellings respectively. Extensions are contemplated.

LITCHFIELD, MICH.—The Litchfield Telephone Exchange commenced operations less than a year ago, but has made good progress and has a promising future. Stromberg-Carlson apparatus is used. It has a 100-drop board and 145 subscribers. There are 9 miles of toll line, the rate being $10 per annum per subscriber.

ROSSEAU, MINN.—C. A. Pearson has been granted a franchise for a telephone exchange in this place.

ST. JAMES, MINN.—The Madelia Telephone Company has been incorporated with a capital stock of $10,000.

COKATO, MINN.—The Cokato Telephone Company is just putting in the Stromberg-Carlson system, with a switchboard capacity of 100 drops. It has 65 subscribers. Rates are 75c. and $1.25 per month.

McINTOSH, MINN.—A telephone line owned by Mr. A. Jensen has a 100-drop board and 60 subscribers. Fifteen miles of toll line are being built. Its rates are $2 for business houses, $1.25 for residences.

GREENWOOD, MISS.—The Yazoo Valley Telephone & Telegraph Company intends adopting the common battery system. Lines are all metallic. It has a 300-drop board; 200 subscribers and 25 miles of toll line. Recent growth has been 100 subscribers and as many more are in sight.

WAHOO, NEB.—The Golden Rod Telephone Company has increased its capital stock to $150,000.

EAGLE, NEB.—The Eagle Telephone Company operates a 50-drop board with 33 subscribers and 9 miles of toll line. Farmers' lines are projected. The rates are 50c. per month.

BRADY, NEB.—The Maxwell & Brady Telephone Company has a 40-drop board, 35 subscribers and 80 miles of toll line. Rates are $1.50 per month. The outlook is good for doubling the business.

HOOPER, NEB.—The Hooper Telephone Company operates Eureka and Stromberg-Carlson apparatus, has a 100-drop board and 145 subscribers. The company is now preparing to put in 50 more telephones in the country east of this place.

BATTLE CREEK, NEB.—The Battle Creek Telephone Company uses Stromberg-Carlson apparatus and has a 10-drop board with 83 subscribers. Thirteen miles of country lines have been recently built and a large extension is projected. This is a new concern.

BEATRICE, NEB.—The German Telephone Company has filed articles of incorporation. The paid up capital of the company is $2,000. The place of business is in Logan township. The articles are signed by J. M. Shuster, president, and John Bubhoom, secretary.

WISNER, NEB.—At the annual meeting of the Cuming County Independent Telephone Company held recently, the following-named officers were elected: L. Dewald, president; J. E. Albers, vice-president; B. H. Von Seggern, secretary, and Peter Witt, treasurer.

NORTH BEND, NEB.—The Farmers' Telephone Company has switchboards at North Bend, 100 drops; Scribner, 100; Dodge, 100; Webster, 100; Snyder, 50; Pleasant Valley, 50. It has 300 subscribers and 70 miles of toll line. Its rates are business houses, $1.50 per month; dwellings, $1.

LINCOLN, NEB.—The Surprise Independent Telephone Company has filed articles of incorporation. The capital stock is $50,000, and the incorporators are A. L. Sperry, E. E. Miller, S. R. Severns, W. H. Greenslit, G. H. Miller, J. H. Greenslit, J. H. Miller, R. Dudley, R. H. Sperry, B. K. Sperry and J. D. Modlin.

FREMONT, NEB.—At a special meeting of the city council the proposition of the Fremont Independent Telephone Company for an amendment to its franchise to permit the adoption of the sliding scale was rejected. The present rates are $2 for business houses and $1 for residences. The change contemplated an increase of 25 cents when 700 telephones were in operation and a further increase when 1,000 were in operation. The change, however, in no event to take place until January 1, 1905, nor until 100 miles of toll line poles had been constructed.

EAST HAMPTON, N. Y.—The East End Telephone Company rents the whole service to two subscribers.

CAMPBELL, N. Y.—The Campbell & Risingville Telephone Company uses Eureka apparatus. It has 120 subscribers and 60 miles of toll line.

LOCH SHELDRAKE, N. Y.—The Loch Sheldrake & Hurleyville Telephone Company has five telephones on its line and charges 10 cents per message.

GROTON, N. Y.—The Farm and Village Telephone Company operates a 200-drop Kellogg switchboard with 75 subscribers and 75 farm lines, with 90 subscribers.

CATON, N. Y.—The Caton Telephone Association uses Bell apparatus, has a 4-drop board, 26 subscribers and 19 miles of toll line. The message rate is 10 cents.

MINAVILLE, N. Y.—The Minaville & Amsterdam Telephone Company has four miles of toll line and runs into the office of the Hudson River Telephone Company at Amsterdam.

ITHACA, N. Y.—The Ithaca Telephone Company operates Century apparatus. It has a 600-drop board with 600 subscribers and 126 miles of toll line. An increase of 200 is projected.

BELMONT, N. Y.—The Belmont Citizens' Telephone Company operates Western Electric apparatus, has a 50-drop board and 235 subscribers. It has 40 miles of toll line, its charge being $12 per year.

BAINBRIDGE, N. Y.—The Riverside Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are Joseph J. Waters, H. G. Robbins and Lewis B. Anderson.

COVENTRYVILLE, N. Y.—The Coventry & Oxford Telephone line runs from Coventry to Oxford through a farming district. It uses a 4-drop board of Standard make, has 27 subscribers and 11 miles of toll line.

MASONVILLE, N. Y.—The Masonville Telephone Company has several toll lines running through the rural districts. It operates a 30-drop board and has 50 subscribers. Its rates are $10. A large increase is projected.

ARKPORT, N. Y.—The Arkport & Bishopville Telephone Company has a 6-drop board here and 28 subscribers. It has 15 miles of toll line, the rate being $5 per year. It has five lines built connecting 85 subscribers at several other places.

ESSEX, N. Y.—The Essex Mutual Telephone Company, which connects with lines in other towns covering 20 square miles and giving a service of 400 telephones, has a 10-drop board and 25 subscribers. The rates of toll service are $6 per annum.

RICHFIELD SPRINGS, N. Y.—The Richfield Springs Telephone Company operates Stromberg-Carlson apparatus; has a 200-drop board and 150 subscribers. Its rates are $15 and $12—two on a line. Rural lines are now being built and the outlook is very promising.

COOPERSTOWN, N. Y.—The Cooperstown Telephone Company operates a 100-drop board, has 200 subscribers and 50 miles of toll line, at rates of $15 and $12—two on a line. Extensions are projected and connections will be made with several towns and cities north.

WESTPORT, N. Y.—The Westport, Essex & Lewis Telephone Company uses apparatus of the Hipwell Mfg. Company. Its switchboard is of 6-drop capacity. There are 90 subscribers, nearly all within the past year, and 22 miles of toll line. The rate is $6 per year.

WARWICK, N. Y.—The Warwick Valley Telephone Company operates a 100-drop board, has 200 subscribers and 40 miles of toll line. An extension of 30 to 40 lines for farmers is projected. The rates are: farm lines, $12; village lines, $15 to $21; country tolls, $10 to $15.

SCHENECTADY, N. Y.—The Schenectady Home Telephone Company, which commenced operations February, 1903, has a 1,920-drop board of Kellogg make and 800 subscribers. Its rates are $44 for business houses and $22 for dwellings. An increase of several hundred telephones is projected.

NEW YORK, N. Y.—A new telephone exchange, which will be known as "Orchard" and which will take 9,600 subscribers from the overcrowded Spring and Eighteenth Streets exchanges, was opened recently at 126 Orchard Street. The telephone company has just completed a building there. There will be 170 operators at the switchboards. Roughly speaking, the new exchange will take in all telephone subscribers east of Third Avenue, the Bowery and Park Row, from Thirteenth Street to Chambers Street.

ELIZABETH CITY, N. C.—The Elizabeth City Telephone Company is now changing its system to the Bell common battery. The switchboard capacity is 250-drops. There are 200 subscribers at rates of $3 for business houses, $1.50 for residences. Seventy-five miles of extension toll lines are now under construction.

HILLTOP, N. DAK.—The telephone office here has a 200-drop board and 225 subscribers. Rates are $15 per year.

LANGDON, N. DAK.—The Langdon Telephone Exchange Company operates a 120-drop board and has 120 subscribers.

AMENIA, N. DAK.—There is a private line here with about 14 instruments which has been in use about ten years.

MANDAN, N. DAK.—The Mandan Telephone Company uses a 200-drop board, has 193 subscribers and 166 miles of toll line. Rates are $1.50 and $2.50. Toll, 25 to 75 cents.

RUSSELLVILLE, OHIO.—The telephone line here is owned by Messrs. Sidwell & Miller, who operate 7 miles of toll line at 15 cents a message.

WOODSTOCK, OHIO.—The Mechanicsburg Telephone Company has opened an exchange here and a number of the farmers in the surrounding districts are arranging for connections.

KINSMAN, OHIO.—C. G. Clisby is organizing a mutual telephone company among the farmers in his vicinity. His intention is to supply telephones to all the farmers in the district.

MILFORD CENTER, OHIO.—The Home Telephone Company is preparing to build two branch farmer's lines in a northerly direction from town. A new line is being built to Burnham.

OBERLIN, OHIO.—The Oberlin Telephone Company operates North apparatus; has a 399-drop board and 329 subscribers. Rates are $15 for residences and $24 for business houses.

MARBLEHEAD, OHIO.—The Kelley Island & Sandusky Cable Company operates Kellogg telephones, a 100-drop board and has 125 subscribers. Rates, $1 and $1.50 for residences, $1.50 for business houses.

MANCHESTER, OHIO.—The apparatus used by the Manchester Telephone Company is Western Electric. The switchboard capacity is 125 drops and there are 119 subscribers, 77 being the increase of one year.

CONNEAUT, OHIO.—The Conneaut Telephone Company has completed extensive improvements to its exchange and has raised its rates from $1 to $1.50 per month. The company has 700 telephones in operation.

FOREST, OHIO.—The People's Telephone Company, with American Electric apparatus, has a 200-drop board, 195 subscribers and 20 miles of toll line. Rates, $1.25 and $1.50. Several more instruments are to be put in.

COLUMBUS, OHIO.—The South Charleston Home Telephone Company, of South Charleston, has been incorporated with a capital stock of $50,000. The names of the incorporators are S. B. Rankin, Alex. Renick, Edwin R. Sharp, Frank L. Beam and Frank A. Davis.

CUMBERLAND, OHIO.—Mr. H. W. McKee is the owner of the telephone system which has been established two years and is growing rapidly. It has a 100-drop local board, 50 miles of toll line and 350 subscribers. Kellogg apparatus is installed.

NORTH LEWISBURG, OHIO.—The North Lewisburg Telephone Company operates apparatus of various makes. It has a 150-drop board with 125 subscribers and 25 miles of toll line. An increase of three farmers' lines is projected and prospects are very bright.

BERGHOLZ, OHIO.—The Bergholz Telephone Company operates Kellogg switchboards, two of 100 drops each, two of about 40 or 50 and one of 16. It has 50 miles of toll line and about 200 subscribers. A switchboard is about to be placed in Carrollton. Residence rates are $12; business, $15.

WASHINGTON, OHIO.—The Washington Home Telephone Company, which operates "American" equipment, has an 800-drop board and 850 subscribers. Rates are $12 and $24 per year. A further extension of the country pole line is contemplated. There is a growing demand for telephones.

WILLSHIRE, OHIO.—The Willshire Telephone Company operates Stromberg-Carlson apparatus. There are 95 subscribers, the rates being $1.50 for business houses and $1 for residences. Increase is steady. Farm lines are being built and a large increase in the number of subscribers will follow.

MASON, OHIO.—The Valley Telephone Company has been forced to temporarily discontinue its service at Mason. Heretofore the company has used the ground return system, but now that the electric railway has been built through the town, the system is unsatisfactory. Metallic circuits will be installed.

ELIDA, OHIO.—The Elida Mutual Telephone Company uses Eureka and other apparatus, has a 100-drop board and 300 subscribers. There are 125 miles of toll line, the rate being $1 per month. There has been 50 per cent. increase of late and by developing the present area there is every prospect of doubling the number of present subscribers.

PAINESVILLE, OHIO.—The North Electric Company, of Cleveland, has just completed the installation of a new telephone exchange here. The new board will accommodate 1,600 lines. The company is now operating 680 lines. It has just announced a new schedule of rates as follows: Business, independent line, $32; two-party line, $24. Residences, single independent line, $20; two-party line, $18; three-party line, $17.

POTTSVILLE, PA.—The Carbon Telephone Company will extend its lines to Tamaqua and Mauch Chunk. At Tamaqua connections will be made with the United Telephone Company's exchange and at Mauch Chunk with the Consolidated Telephone Company's system.

PITTSBURG, PA.—The Pittsburg & Allegheny Telephone Company informs us, through Manager Brown, that business is very prosperous. Apparatus used is Kellogg, North, and its own make. Switchboard capacity, 21,200; number of subscribers, 17,000. There are 800 miles of toll line and many different rates. The company expects to spend $800,000 in improvements, extensions and new plants within the next 12 months. The present capital is $5,000,000; bonds, $1,400,000.

PITTSBURG, PA.—The new exchange of the Central District & Printing Telegraph Company was connected up on the night of May 30, and the connections of 4,000 lines were changed from the old to the new switchboard in about three minutes' time. The new exchange is at the corner of Fourth Ave. and Cherry Alley. The new switchboard is of the lamp signal relay type with an ultimate capacity of 9,000 lines, and will take care of approximately 14,000 subscribers. The present switchboard equipment has a capacity for 6,000 subscribers.

PITTSBURG, PA.—A group of telephone companies in western Pennsylvania, the stocks of which were held by the United Telephone & Telegraph Company, of New Jersey, which also owned the independent plants in Baltimore and Wilmington, Del., has changed hands, the control having passed from the Baltimore syndicate headed by Br. George R. Webb to the Pittsburg & Allegheny Telephone Company. The latter company has increased its capital stock to $5,000,000, which is made up half and half of preferred and common stock. The consolidation was effected through the Central Trust Company, of Baltimore.

CHESTERFIELD, S. C.—The Chesterfield Telephone Company has enlarged its business considerably this year and is about to extend its toll line. It has a 50-drop board and 86 subscribers.

ST. MATTHEWS, S. C.—The St. Matthews Telephone Company operates a Clark automatic 72-drop board and has 30 subscribers. The rates are $1.50 for business houses, $1 for residences. An extension of 15 or 20 miles of toll line is contemplated.

MILLTOWN, S. DAK.—The Milltown Telephone Company has a 12-drop board and 38 subscribers, 32 miles of toll line at 15c. per message. An increase is projected.

KNOXVILLE, TENN.—The East Tennessee Telephone Company will begin at once to make extensive improvements in its plant on Seventh Street in this city. New switchboards will be installed at a cost of $8,000.

MINERAL WELLS, TEX.—A franchise has been granted by the City Council to the Independent Telephone Company to operate an exchange in this city.

FORT WORTH, TEX.—The Texas Telephone & Supply Company has been incorporated in this city, the capital stock being $10,000. The incorporators are L. J. Taylor, W. G. Liggett, C. C. Houston and Warren E. Martin.

FT. WORTH, TEX.—The Ft. Worth Telephone Company has a 2000-drop board and 1951 subscribers to commence business, but is not yet in operation. The apparatus is American Electric make. The company will occupy its own building, with everything up-to-date.

SHERMAN, TEX.—The Grayson County Telephone Company is equipped with a 600-drop Kellogg switchboard. It has 500 subscribers in Sherman, 647 in Denison. Between the two cities are 50 miles of toll line, which is free to subscribers. The capital stock has been increased to $340,000 to meet the rapid progress of the company. Mr. G. Holmes is manager.

OGDEN, UTAH.—The City Council has granted a franchise to the Independent Home Telephone company and work on the new system will be commenced in the near future.

SALT LAKE CITY, UTAH.—The Independent Home Telephone Company has notified the city council that work has been commenced on the construction of its exchange and that the company has filed a bond of $25,000 as required by the terms of the franchise.

BRADFORD, VT.—The Bradford Telephone & Telegraph Company furnishes service to 300 subscribers with a 100-drop board. It has 100 miles of toll line, the rates being $12 per year.

VERGENNES, VT.—The Addison & Panton Telephone Company employs Bell apparatus and has a 25-drop board with 150 subscribers and 70 miles of toll line, the charge being $12 per year for toll service.

SPRINGFIELD, VT.—The New England Telephone & Telegraph Company supplies the apparatus of the Springfield Local Telephone Company. A 40-drop board affords service to 175 subscribers at $12 for dwellings and $18 for business houses.

MIDDLEBURG, VT.—The Addison County Telephone Company uses apparatus of Western Telephone Construction Company. The switchboard has a capacity of 350 drops. There are 350 subscribers. The company has 50 miles of toll line, the rates being $1 per month. Extensions are projected.

FAIRLEE, VT.—The Fairlee Telephone Company is a branch line of the New England Telephone & Telegraph Company and connects with the lines of that company, having subscribers into So. Fairlee, Bradford and other places. It operates a 20-drop board and has 100 subscribers in Fairlee. The apparatus used is American Bell.

ESSEX, VT.—The Central Telephone Company operates two switchboards of 100-drop capacity each. It supplies service to 300 subscribers at $12 per year on grounded lines, $18 to $21 on metallic circuit. A large increase is projected. The company furnishes service to the towns of Jerico, Underhill, Westford, Fairfax, Williston, Colchester, Grand Isle and others, as well as to this town.

CHARLESTOWN, W. VA.—C. C. Gaver, of Hillsboro, Va., has been granted a franchise for the Old Dominion Telephone Company to build lines to Harpers Ferry.

ALTO, WIS.—The Alto Telephone Company has been incorporated with a capital stock of $3,000.

OSHKOSH, WIS.—It is stated that the Winnebago Telephone Company will construct an independent telephone system in this place.

MAPLE GROVE, WIS.—There are 120 miles of toll line from this place and a further extension is projected. Rates are 20c. per message.

STEVENS POINT, WIS.—The Stevens Point Mutual Telephone Company has been organized, and the work of constructing its system will be commenced at once.

POYNETTE, WIS.—The Leeds Farmer's Telephone Company has 150 subscribers and 200 miles of toll and party lines which connect with those of five different companies.

ORFORDVILLE, WIS.—The Orfordville Telephone Company has Standard apparatus and a 200-drop board, with 185 subscribers and 20 miles of toll line. Recent growth—75 numbers and 100 more are projected.

REEDSBURG, WIS.—The Reedsburg Telephone Company has 260 subscribers and expects a large increase in the number. It uses Western Telephone Construction Company's apparatus and has a 300-drop switchboard.

MT. HOREB, WIS.—The Mt. Horeb Independent Telephone Company operates a 200-drop board, has 150 subscribers, and 40 miles of toll line. It is branching out in every direction and makes a fine showing for its one year of existence.

BELLEVILLE, WIS.—The Belleville Telephone Company operates a 100-drop board, has 65 subscribers and five miles of toll line. Stromberg-Carlson apparatus is used. Rates are $1 for residences, $1.50 for business houses.

GRAND RAPIDS, WIS.—The Wood County Telephone Company operates a Stromberg-Carlson full metallic system. It has a 400-drop board and another 100-drop section will be put in. Service is given to 486 subscribers and a daily increase is recorded. Rates are $27 per annum for business, $12 per annum for dwellings.

BRUCE, WIS.—The Chippewa Valley Telephone Company has five exchanges, one with a 100-drop switchboard, four with 50-drop boards. There are about 200 subscribers paying $1.50 per month for business houses and $1.25 for residences. There are 80 miles of toll line and thirteen toll stations. Prospects are excellent.

WAUSAUKEE, WIS.—The Wausaukee Telephone Company makes a good showing for the first year of its existence. It has an 80-drop board with 77 subscribers at $1 per month. There are 60 miles of toll line; one to Marinette just completed and other extensions in progress to connect with the Mineral Range Telephone Company and Dunbar.

EVANSVILLE, WIS.—The Evansville Telephone Exchange is making such rapid progress that the demand exceeds the capacity of the apparatus. This is American and Standard. There is a 300-drop board with 260 subscribers. The rates are $1 for residences and $2 for business houses. The company contemplates building several country lines.

ELECTRIC LIGHT AND POWER.

RUSSELLVILLE, ALA.—There is reported to be a movement on foot here to put in an electric light plant.

STOCKTON, CAL.—The citizens have voted to issue $160,000 bonds for the construction of a municipal electric light plant.

SAN FRANCISCO, CAL.—The Humboldt Power Company has been incorporated by Chas. P. Doe, of Alameda; Jas. Stanley, of Sausalito; C. Alvin Baird, of Eureka, and others, to supply electric light and power; capital, $500,000.

OAKLAND, CAL.—The contract for lighting the streets and public buildings has been awarded to the Oakland Gas Light & Heat Company at $7.25 per light (2,000-cp arc) per month, all night and every night except full moon, night preceding and night following; lighting public buildings—incandescent lights, 5 cts. per kw-hour.

SAN FRANCISCO, CAL.—The Butte & Plumas Railway, which is to extend 65 miles from Oroville to Quincy, Cal., with its 25-mile extension—the Indian Valley Railway—will be operated by electricity. The California Gas & Electric Corporation can supply current at Oroville. The Western Power Company's Big Bend plant which may be constructed within the next two years will also be available. The owners of the railroads, however, will install a plant at the upper end of the line to supply a part of the power. They have 5,000-hp available at one point and have also several other good power sites. The roads will do a large business in hauling lumber and other freight.

GREENWICH, CONN.—The Glenville Power & Water Company, organized here, with a capital of $10,000,000, to supply water to Greenwich, Conn., and Rye, Harrison and Mamaroneck, N. Y., and to generate and distribute electricity throughout these and other sections for public and private use. Wm. J. Tingue, Nathaniel Wetherell and Henry H. Adams are the corporators.

WINDER, GA.—The citizens have voted to issue $15,000 electric light bonds.

ATHENS, GA.—Capt. Jas. White is interested in the development of the power at Barnett Shoals for electrical and manufacturing purposes.

AUGUSTA, GA.—It is said that plans for organizing a new electric light and power company in Augusta are nearing completion. The merchants interested believe they can furnish their own electricity at a saving over the present cost.

ORO FINO, IDAHO.—F. M. Mitchell, of Grangeville, is preparing to install an electric light plant and a water works at this place. Power for generating the electricity and running the pumps will be obtained from the waters of Oro Fino Creek, which will be utilized by means of a flume about 1,500 ft. in length.

EDWARDSVILLE, ILL.—The City Council has voted an appropriation of $30,000 for city lighting. This means that the council favors the scheme of a city lighting plant. The question will be submitted to a vote of the people and if carried, bonds will be issued to raise the funds.

STERLING, ILL.—It is stated that the Rock River will be dammed at a point 12 miles west of here, the improvements to cost about $200,000. The electrical power developed at this point will be used for the operation of electric railways now being constructed in this section of the state. It is stated that the energy will be transferred a distance of 300 miles. The company also expects to furnish power for factories within this radius.

BRAZIL, IND.—The Brazil Electric Company has purchased the city electric light plant and will make many improvements.

NOBLESVILLE, IND.—An electric plant is to be constructed here for Thos. Griffin, to cost $70,000. About 1,000-hp will be developed.

WASHINGTON, IND.—Simeon Loudenback, James C. Keeler and George Lesler Wilkins have organized and incorporated the Citizens Light & Fuel company and will construct and operate an electric lighting plant in this city. The capital stock is $100,000.

SOUTH BEND, IND.—It is stated that plans have been decided upon by Chas. A. Chapin, of the South Bend Mfg. Company, which controls the water power of west race, for equipping the race so as to supply power for the electric light plant in this city and making it supplementary to the electric plant in Buchanan, Mich.

ANDERSON, IND.—The city council has contracted with the Westinghouse Company, of Pittsburg, for a turbine engine at a cost of $19,250 to supply more power for the city electric plant. The new turbine is to have a capacity of 400-kw. The General Electric Company challenges the bid of the Westinghouse Company and charges the council with being unfair, its bid being $18,000. The council will purchase another engine within the next year or two.

ATLANTIC, IA.—The City Council has ordered the joining of the water works and city lighting plants. The work proposed will cost about $12,000.

HARPER, KAN.—Mayor Baumstark has appointed a committee to investigate the question of constructing an electric light plant.

HARRODSBURG, KY.—Bids will be received by C. D. Thompson until June 27 for $18,000 electric light plant bonds.

SANFORD, ME.—The Sanford Light & Power Co., of Portland, has been incorporated; capital $50,000. C. A. Bodwell is president; W. J. Bodwell, treasurer, both of Sanford, Me.

MERRIMAC, MASS.—The town has voted to establish water works and a lighting plant.

MANSFIELD, MASS.—The citizens have voted to issue $40,000 bonds for an electric light plant.

MAPIMI, MEXICO.—An electric power transmission plant, which is said to be the largest in Mexico, has just been completed here by the Penoles Mining Company. The electrical energy is transmitted to the Ojuela mines where it is used for operating the pumps and machinery.

FORD, MICH.—The citizens have voted to issue bonds for an electric light plant.

NASHVILLE, MICH.—The Village Council has granted a franchise to the Marshall Electric & Power Company to install a plant at Scipio, three miles northeast.

LYLE, MINN.—Improvements are to be made to the electric light plant in this place.

BUHL, MINN.—Bids will be received soon by M. A. Nichols, for the construction of an electric light plant. Oscar Claussen, St. Paul, is engineer.

TWO HARBORS, MINN.—The Council has decided to install new electric machinery on specifications by Oscar Clausen, of St. Paul, engineer, to cost about $9,000.

CALEDONIA, MINN.—The contract for constructing an electric light plant has been awarded to S. G. Reque, now at Caledonia, Minn. The plant to be erected by the city under the supervision of S. G. Reque.

STILLWATER, MINN.—The Western Gas & Improvement Company has taken over the plants of the Gas & Electric Light Company and the Apple River Power Company and will make extensive improvements.

McHENRY, MISS.—The City Council has granted the Bauer Lumber Company a franchise for an electric light plant.

YAZOO CITY, MISS.—Engineers Kirkpatrick & Johnson, of Jackson, Miss., have plans for an electric light plant for Yazoo City.

RENO, NEV.—The controlling interest in the Nevada Power, Light & Water Company has been purchased by Senator Flannagan, at a cost of $200,000. Extensive improvements will be made to the plant.

LACONIA, N. H.—The plant of the Laconia Electric Light Company was destroyed by fire on May 26. It will be rebuilt at once.

TECUMCARI, NEW MEX.—An electric light and waterworks plant is to be established here. Merril H. Fisher, of Alamagordo, is interested.

BUFFALO, N. Y.—A special committee of the Board of Councilmen appointed to consider the lighting question has reported in favor of constructing a municipal electric light plant. This will be its alternative to the proposition approved by the aldermen to accept the offer of the General Electric Company to supply 4,000 or more lamps at $70 per lamp per year.

EDENTON, N. C.—The citizens have voted to issue $30,000 bonds for an electric light plant and water works.

CHARLOTTE, N. C.—W. Drummond Marrow, of Charlotte, has secured the contract for putting in a $10,000 electric light plant at Lumberton in this state.

FAYETTEVILLE, N. C.—The Fayetteville Gas & Electric Company has been incorporated with $33,000 authorized capital. W. A. McKenney, of Washington, D. C., is the largest shareholder.

WALDO, OHIO.—Michael Brothers are installing an electrical plant and will furnish light and power throughout the village.

BLIND RIVER, ONT.—D. S. Pindell, of Sault Ste. Marie, Mich., will construct a power plant at Blind River to cost $5,000.

BAKER CITY, ORE.—The Baker City Gas & Electric Company's electric plant in Baker City, Oregon, has been destroyed by fire with a loss of $30,000; insurance $10,000. It will be rebuilt.

NEW FLORENCE, PA.—The New Florence Light & Power Company is reported organized and has secured the contract for lighting the borough.

BENNETTSVILLE, S. C.—A new $15,000 electric light plant is being constructed here.

COLUMBIA, S. C.—G. A. Guignard, of Lexington County, S. C., has secured control of a number of fine water powers in Lexington County. Lewis J. Guian, of Columbia, S. C., is also interested.

ROCK HILL, S. C.—The Catawba Power Company, of Rick Hill, has increased its capital stock from $650,000 to $750,000. The company is erecting one of the largest power plants in the state for electrical purposes.

HURON, S. D.—The Consolidated Gas & Electric Company, of Huron, has been incorporated, with a capital of $25,000.

SPRINGFIELD, TENN.—The citizens have voted to issue $35,000 bonds for water works and an electric light plant.

BEAUMONT, TEX.—Hal W. Greer and associates are stated to have secured a franchise for an electric light plant.

GEORGETOWN, TEX.—It is announced by the Georgetown Water and Electric Company, that about $10,000 is to be expended in improvements by that company.

BAY CITY, TEX.—The Bay City Ice, Light & Power Company has been incorporated; capital $50,000. Incorporators: T. H. Stone, W. T. Goode and G. M. McGill.

BEAVER, UTAH.—A large power plant will be installed at this place within the next few months, the power to be derived from Beaver River. The power will be used in local mines and mine owners are the parties pushing the project.

SEATTLE, WASH.—It is stated that the Seattle Electric Company contemplates improvements this season to cost $500,000.

PT. TOWNSEND, WASH.—The Townsend Gas & Electric Company was formed in 1893 with $150,000 authorized capital. It furnishes 17 enclosed arcs and 638 incandescent lights.

MARINETTE, WIS.—It is stated that the Street Railway Company will rebuild the electric light plant and make other changes.

GRANTSBURG, WIS.—Bids are wanted June 25 for $8,000 bonds for an electric light plant. A. A. Anderson is Village Clerk.

THE ELECTRIC RAILWAY.

RIVERSIDE, CAL.—H. F. Huntington has purchased a franchise for an electric railway from Riverside to Corona, a distance of about 10 miles.

LOS ANGELES, CAL.—The Los Angeles & Redondo Electric Railway has increased its capital stock from $500,000 to $1,000,000. The new stock is to be issued for the purpose of making betterments and extensions.

JEWETT CITY, CONN.—The Senate has passed a resolution incorporating the Voluntown & Jewett City Street Railway Company.

HARTFORD, CONN.—The Railroad Committee of the General Assembly has reported favorably the resolution incorporating the Woodbury & Waterbury Street Railway Company.

NEW HAVEN, CONN.—The Railroad Committee of the General Assembly has reported favorably the resolution authorizing the Fair Haven & Westville Railway to make numerous extensions.

BRAIDENTOWN, FLA.—The Manatee Light & Traction Company has been incorporated, with a capital stock of $100,000, to build an electric railway and operate light, heat and power plants. The incorporators of the company are John A. Graham, W. A. Carter and Nina H. Graham.

ROME, GA.—The town of Rome has raised the $15,000 bonus asked of the citizens of that town by Northern capitalists for extending the trolley line to Lindale. Improvements to cost $150,000 will be made, including an electric plant.

MT. VERNON, ILL.—The Southern Illinois Electric Railway Company has been incorporated with a capital stock of $50,000, with the principal office at Mt. Vernon. The incoporators and first board of directors are John R. Piercy, Geo. F. M. Ward, Samuel Casey, Louis G. Pavey, Samuel T. Maxey and Albert N. Johnson, all of Mt. Vernon, Ill.

SPRINGFIELD, ILL.—The Springfield and Jacksonville Rapid Transit Company has been incorporated with a capital stock of $500,000. The majority of the persons interested are residents of St. Louis and it is said that Donk Bros., of St. Louis, who operate a large coal and coke company, are behind the syndicate. The principal offices of the company will be in East St. Louis. The incorporators and first board of directors are James W. Buel, E. C. Donk, Edwin H. Conrades, of St. Louis; L. H. Coleman, of Springfield; E. C. Greenleaf, of East St. Louis, and M. W. Brown, of New Berlin.

MUSCATINE, IA.—It is reported that the International Construction Company, of Detroit, has been awarded the contract for building the proposed interurban railway between Muscatine and Davenport.

KEOKUK, IA.—Articles of incorporation have been filed by the Keokuk & Western Illinois Railway Company, capitalized at $1,000. The company proposes to build an electric railway. The incorporators and first board of directors are Fred. P. Vose, of Evanston, Ill.; George E. C. Johnson, Hubert E. Page, C. C. Breurer and B. J. Jones, of Sargent & Lundy, Chicago.

DES MOINES, IA.—The Western Iowa Interurban Railway Company has been formed to build an electric railway between Des Moines and Council Bluffs. It is capitalized for $1,000,000. A board of directors has been selected as follows: H. H. Polk, of Des Moines; Clyde Brenton, of Dallas Center; E. W. Weeks, of Guthrie Center; J. A. Nash, of Audubon; G. W. Cullison, of Harlan; J. W. Davis, of Council Bluffs.

GLASGOW, KY.—The Glasgow, Burkesville & Cumberland Valley Traction Company has been incorporated with a capital of $500,000.

MAYSVILLE, KY.—The Marysville & Mt. Olivet Traction Company has been organized to build an electric railway between Maysville and Mt. Olivet. The distance is about 25 miles. John Duley is president; E. Kenton, A. R. Howard and George W. Dye, vice-presidents; W. W. Ball, treasurer, and James W. Fitzgerald, secretary.

AUGUSTA, ME.—The name of the Berwick, Eliot & York Street Railway Company has been changed to Portsmouth, Dover & York Street Railway Company. The company has voted to increase its capital stock from $80,000 to $650,000.

CARIBOU, ME.—Articles of incorporation have been filed by a company that plans to build an electric railway from Caribou to Perham. The road will be 15 miles long, and the capital stock is $210,000. The directors are S. L. White, J. D. Emery, Corydon Power, Eugene A. Holmes, Herbert A. P. Edwards.

GUADALAJARA, MEXICO.—A project is on foot to build an electric interurban railway between this city and Lake Chapala. B. F. Hammett and Felix Martinez, of El Paso, Tex., are interested in the enterprise. Application will be made to the Mexican Government for a concession for the proposed road.

CHIHUAHUA, MEXICO.—The American syndicate which has a concession for establishing an electric street railway system here has secured an extension of its option on the existing street railway property and it is reported that the work of constructing the new system will soon begin. The electric power for operating the lines will probably be furnished by the Compania Industrial Mexicana.

DETROIT, MICH.—The Michigan Central Traction Company proposes to build a line from Battle Creek to Lansing. The road will be 57 miles long and will be built in three divisions. Contracts for construction have been placed with M. W. Burwell, of New Haven, Conn. The company is capitalized at $1,300,000 and the officers are S. Bugart, Cleveland, president; J. W. Ewing, Grand Ledge, treasurer; F. H. Goaby, New York; J. S. Mudge, Grand Ledge, and E. T. Pangborn, Battle Creek, directors.

GRAND RAPIDS, MICH.—The Grand Rapids Electric Railway Company has been incorporated under the general railroad law of the State of Michigan, with a capital stock of $2,000,000, for the purpose of building an electric railway from Grand Rapids to a point on Lake Huron hereafter to be determined. Also a branch line from Grand Rapids to the city of Lansing, the length of the entire line, including branches, being about 250 miles. The directors are J. W. Boynton, M. C. Weaver, C. J. Post and J. H. Dority, of Grand Rapids; J. C. Yarger, of Freeport.

BOZEMAN, MONT.—The Bozeman Light & Traction Company has purchased the entire plant and holdings of the Gallatin Light, Power & Railway Company and the Bozeman Street Railway Company. The new corporation intends to make important improvements in the present plant and system.

NEW PALTZ, N. Y.—The foreclosure sale of the New Paltz and Poughkeepsie Traction Company is advertised for June 27 at New Paltz.

DUNKIRK, N. Y.—The Railroad Commissioners have authorized the Dunkirk & Fredonia Railroad Company to increase its capital stock from $150,000 to $200,000 to provide for new construction.

BUFFALO, N. Y.—The Amityville & Huntington Railroad Company, of Buffalo, has been incorporated with a capital of $250,000. Directors: W. K. Putnam, A. S. Sanborn, J. S. Shearman and C. B. Smith, Brooklyn.

NEW YORK, N. Y.—The Buffalo & Batavia Construction Company has been incorporated to build an electric railway; capital, $10,000. Incorporators: Spencer Kellogg, George L. Lewis and Stuart R. Mann, all of Buffalo, N. Y.

NEW YORK, N. Y.—The Ocean Electric Railway Company of Rockaway, has applied for a franchise to build an electric railway between Rockaway and Far Rockaway. The road is to be six and a half miles long. It is understood that the Long Island Railroad is behind the company.

AMITYVILLE, N. Y.—The Amityville & Huntington Railroad Company, with principal office in Brooklyn, has been incorporated to build an electric railway over 14 miles long from Amityville to the Long Island railroad station in Huntington. The capital is $250,000, and the directors are W. K. Putnam, A. S. Sanborn, J. S. Sherman, Harry A. Hanbury, Robert A. Sharkey, Frank Jacobs, J. D. Brown, Ernest Houchin and C. B. Smith, of Brooklyn.

GLOVERSVILLE, N. Y.—The Adirondack Lakes Traction Company, a reorganization of the Mountain Lake Electric Railroad Company, has been incorporated. The new company has a capital of $60,000, and the directors are Theodore Schiess, of Brooklyn; John M. Marvin, of New Haven, Conn.; Wm. A. McDonald, James Washburn, Elman Hitts, William L. Weed, Jeremiah Wood, of Gloversville; Addison Keck, of Johnstown, and Philip D. Shaul, of Amsterdam.

WADESBORO, N. C.—The Merchants' Railway Company has been chartered to build an electric railway here. The incorporators are R. L. Hardidson, W. J. McLendon, Jr., James A. Leak, H. H. McLendon and others.

DEVIL'S LAKE, N. D.—A. B. Kerlin, of Devil's Lake, F. B. Wood, of Minneapolis, and others are to organize the Devil's Lake Rapid Transit Company, with a capital stock of $50,000, to build an electric railway from Devil's Lake to Chautauqua.

CINCINNATI, OHIO.—The Loveland & Cincinnati Traction Company has been incorporated with $50,000 capital stock, by Henry Burkholt, Wallace Burch, Franklin Bank, Wm. Munsell, Simeon Johnson and Henry Sachsleben.

DAYTON, OHIO.—The Dayton & Northern Traction Company; the Greenville & Union City Traction Company and the Union City, Winchester & Muncie Traction Company have bee nconsolidated under the name of the Dayton & Muncie Traction Company. The roads are owned by the same interests.

COLUMBUS, OHIO.—The Ohio & Indiana Street Railroad Company has been incorporated by J. D. DeWitt, Dr. Harvey Cook, L. Bohnham and others to build an air line electric road from Cincinnati to Indianapolis. The company is incorporated for $10,000, but this will be increased to $2,000,000.

CLEVELAND, OHIO.—Plans are being prepared for the erection of the power house of the Buffalo, Dunkirk & Western Railway which is being promoted by Cleveland people. It has about been decided to utilize gas for fuel. It is proposed to install large gas engines and utilize the gas direct, without the use of boilers.

CINCINNATI, OHIO.—Stockholders of the Cincinnati, Milford & Eastern Traction Company have voted to increase the capital stock from $300,000 to $1,000,000. The officers are S. B. Day, Elyria, president; G. H. Chamberlain, Elyria, vice-president; W. F. Roudebush, Cincinnati, treasurer; W. R. Medaris, Milford, secretary. The power house will be at Milford.

CLEVELAND, OHIO.—The Findlay & Southern Railway Company has changed its name to Columbus & Lake Erie Railway Company. The company was organized two years ago to build a line from Columbus to Findlay and eventually to Toledo. The Everett-Moore embarrassment tied up the project but now new capital has been interested and it is claimed the road will be built this year. R. Rosentsock, of Cleveland, is chief engineer of the project.

NEW PHILADELPHIA, OHIO.—The Tuscarawas Traction Company, which has recently been acquired by Tucker, Anthony & Company, of Boston, has been reorganized with the following officers: Phillip Saltonstall, Boston, president; James Rutherford, Cleveland, vice-president; Chauncy Eldridge, Boston, secretary-treasurer, G. W. Rounds, Canton, General manager. It is probable that the road will be extended to Coshocton and Zanesville to complete the through Cleveland-Columbus line.

YOUNGSTOWN, OHIO.—The Youngstown & Southern Railway Company has increased its capital stock to $1,500,000. Officers have been elected as follows: Gen. Asa W. Jones, president; W. S. Anderson, vice-president; J. H. Ruhlman, secretary-treasurer; R. L. Andrews, second vice-president and general manager. George Todd, Jr., has been appointed chief engineer and he is taking steps to locate a site for a power house and to close contracts for material required for equipping and building the road. The power plant will probably be located in the North Lima coal fields. The line will extend from Youngstown to Lisbon, North Lima and East Liverpool.

PHILADELPHIA, PA.—The City Council has passed the bill approving the merger of five elevated passenger railway companies—the Market Street, the Frankford, the Passayunk, the Ridge Avenue, and the Germantown, and the Broad Street Subway Passenger Railway Company, under the name of the Market Street Elevated Passenger Railway Company, which is to have "all of the assents and privileges heretofore granted to said several companies."

NEW INDUSTRIAL COMPANIES.

THE ELECTRIC CONVEYING MACHINERY COMPANY, of New York, has been incorporated with a capital of $5,000. Directors: J. T. Emery, S. C. Miller and R. A. Weber, of New York.

THE HANSON ELECTRICAL COMPANY, Jamestown, N. Y., composed of E. P. Bailey and James E. Hanson, has been organized to deal in all kinds of electrical supplies and carry on a general electrical construction business.

THE INDIANA AUTOMOBILE COMPANY, of Indianapolis, has filed articles of incorporation with a capital stock of $25,000. The incorporators are John B. Cockrum, S. W. Elston, W. F. Clevenger, Henry Jameson and C. L. Pepper.

THE STANDARD ENGINEERING COMPANY, capital stock, $50,000, has been incorporated at Cleveland, Ohio, by F. A. Little, G. L. Wells, A. G. Wells, W. C. Sheppard and Stanley Shaffer. The company will do civil engineering and will build electric railways.

OBITUARY.

MR. PAUL WERNER, an inventor, died at his home, Hoboken, on Sunday last. He devised the noiseless cable wheel which was used when the North Hudson County Railway operated its elevated road between Hoboken and Jersey City Heights, by cable. He also patented a number of machines used in the making of lead pencils. His death was caused by brain fever, said to be due to overwork on an electric motor which he had been trying to perfect for more than a year.

PERSONAL.

J. J. CARTY.

MR. J. J. CARTY, who was elected to the presidency of the New York Electrical Society last week, is the fifteenth president of this, the oldest electrical organization of the kind in the country. A biographical sketch of Mr. Carty was given in these pages in the issue of April 5, 1902. He was born April 14, 1861, at Cambridge, Mass., and after his school studies and preparatory work for college, entered the telephone service, so that to-day he has had nearly a quarter of a century of active telephonic experience, making him one of the oldest and most prominent engineers connected with the Bell telephone system. He has not only been a designing and construction engineer to whom may be given the credit of a great deal of the improvement in American exchange practice since he entered the service of the New York telephone interests in 1889, but he has also to his credit several well-known inventions and improvements in connection with telephonic apparatus. Some of these inventions are acknowledged to be fundamental in their character; such, for example, as the Carty bridging bell, which in its way, is as well known as the Edison incandescent lamp or the Sprague electric railway system. Over Mr. Carty's patents some of the fiercest electrical litigations of the last ten years have been fought, attesting to their importance and value in the art. Mr. Carty has not only been a member of the New York Electrical Society for several years and an active contributor to its transactions, but has also been prominent and zealous in the work of the American Institute of Electrical Engineers, of whose board of management he is now the senior member, besides being on several important committees. Mr. Carty is also an active member of the American Electrotherapeutic Society, and a member of the Society of Arts. He is a man of broad culture and liberal tastes, and it is not out of place to mention that by marriage he is connected with one of the foremost theatrical families in this country, being a brother-in-law of Miss Annie Russell, the distinguished actress, and of Mr. T. Russell, the original creator of the part of Little Lord Fauntleroy. The New York Electrical Society has enjoyed remarkable prosperity during the past few years, and there is every reason to be confident that its work will be developed and advanced under the progressive administration of its new president.

MR. GEORGE WESTINGHOUSE is listed to sail for England this week on the American liner *New York*.

MR. E. W. RICE, JR., vice-president General Electric Company, has been made a trustee of Union College, Schenectady.

MR. C. A. COFFIN, president of the General Electric Company, returned from Europe last Sunday by the White Star liner *Cedric*.

MR. NORMAN E. LEAVEY, of the Minneapolis General Electric Company was a recent visitor to Boston on a business trip east.

DEAN V. C. ALDERSON, of the Armour Institute of Technology, has accepted the presidency of the Colorado School of Mines.

MR. C. P. STEINMETZ has been made a doctor by Union College, Schenectady, in recognition of his great work in electrical engineering.

MR. CORNELIUS VANDERBILT has been elected a director of the Mexican Telegraph Company in place of the late George G. Williams.

MR. ARTHUR L. COOK, assistant in electrical engineering at the Worcester Polytechnic Institute, has accepted a position with Westinghouse, Church, Kerr & Co., of New York City.

PROF. ALBERT KINGSBURY, of the Department of Mechanical Engineering, Worcester Polytechnic Institute, has resigned to accept a position with the Westinghouse interests in Pittsburg.

MR. CLARENCE A. CHANDLER, superintendent of the Washburn shops of the Worcester Polytechnic Institute, has resigned, and will probably devote himself to the manufacture of machinery.

MR. GEORGE R. MACNAMARA, formerly with the Babcock & Wilcox Boiler Company, at Bayonne, N. J., has joined the engineering force of the B. F. Sturtevant Company, Jamaica Plain, Mass.

MR. JOHN B. PARSONS, president of the Philadelphia Rapid Transit Company, is about to start on a European trip during which he will study traction practice in England and on the Continent.

MR. RALPH D. MERSHON, consulting electrical engineer, has returned recently from Europe and will be on hand at the Niagara Institute meeting to present his paper on grounded wires.

MR. CHARLES RUFUS HARTE, of the engineering department of Stone & Webster, Boston, has returned from a protracted stay in Indiana, in connection with the Clinton extension of the Terre Haute Electric Company.

MR. CALVIN W. RICE, vice-president of the Nernst Lamp Company, is sailing for Europe on a pleasure trip, which is greatly needed after his strenuous work of the past year of two. While abroad, he will look into lighting developments in his own field.

MR. FRED F. SPRAGUE, son of president A. B. R. Sprague, of the Worcester Electric Light Company, and the Worcester & Holden Street Railway Company, has been appointed assistant to the local supervisor of wires, with office in the Worcester City Hall.

MR. WESLEY STEELE, M. E., formerly with the Perth Amboy Terra Cotta Company, at the Perth Amboy Works, has taken a position in the sales department of the A. D. Granger Co., contracting engineers, at the New York office, No. 95 Liberty Street, New York City.

MR. I. L. STOREY, the well-known designer of electric motors, mining apparatus, etc., has become actively identified with the Magneto Electric Company, Inc., of Amsterdam, as its electrical engineer, etc., and is proceeding energetically to develop various lines of its product.

MR. C. F. KENT, who has been well known in Bell and independent telephone circles, and is now associated with Mr. LeRoy W. Stanton, is just completing the work on the cable distribution, etc., for the addition to the plant of the Cambridge Telephone Company, of Cambridge, Ohio.

MR. E. W. TRAFFORD has resigned his position as general superintendent of the Virginia Passenger & Power Company, at Richmond, Va., to engage in consulting engineering work. Mr. Trafford has had the supervision of nearly all the electric lighting and power interests in Richmond for more than fourteen years. He is a member of the Institute.

COLUMBIA GRADUATES.—The following students have graduated in electrical engineering at Columbia University: John Winfrid Ager, Malcolm Curry, Lester F. Dittenhoefer, John Pelham Faber, Eugene Frank, Louis George Henes, Henry E. Jacoby, William D. Kayser, Leo Joseph Matty, Leclanche Moën, Charles Miles Pond, Julian C. Smallwood, Walter J. Spiro, William M. Van Cise, William E Ver Planck, Francis P. Walsh.

MR. W. S. BARSTOW, consulting electrical engineer, of New York City, has left on an extended trip through the West, his destination being Portland, Ore., where he is engaged in work for the Portland General Electric Company. He has just completed a large power plant and electric drive for the Hartford Carpet Corporation, Thompsonville, Conn., and work upon the power plant for the A. B. See Electric Elevator Company has been commenced.

MR. F. A. FOCKE, engineer for the Federal Telephone Company, Cleveland, has resigned his position there and joined the staff of Mr. LeRoy W. Stanton, the consulting and constructing telephone engineer, who has on hand now a number of contracts for building, rebuilding and equipping several exchanges. Mr. Focke's technical ability and practical experience in telephone engineering make him a valuable addition to the Stanton forces, especially for multiple cable construction and distribution.

MR. CLARENCE P. FOWLER, who, for the past two years has been connected with the New York construction office of the Westinghouse Electric & Mfg. Company, has been transferred to Baltimore, where the Westinghouse Company have several large contracts on hand, perhaps the most notable of which are the complete equipment of the Baltimore Street Railway with a high tension three-phase generating station fed through rotary sub-stations, and the installation of the single-phase railway from Baltimore to Washington.

COL. E. J. SPENCER.—The *World's Fair Bulletin*, of St. Louis, says: "The great civic parade on May 2, in which 20,000 persons participated, was in every way worthy of the occasion, and of the great municipality of St. Louis. It was viewed by her own people with just pride, and by all visitors with wondering admiration. In connection with her annual fair and exposition, the city has long been famous for civic pageants, but, thanks to the organizing talents of Col. E. J. Spencer, this was her most brilliant and gratifying success in that line."

MR. BARTH VON WEHRENALP, chief architect of the government, Austrian Ministry of Commerce, and technical manager of the telegraph and telephone department of the Empire of Austria, and Mr. G. Hubert Dietl, engineer,

are now visiting this country, and will spend some time here in the inspection of electrical improvements and inventions, particularly with relation to the telegraph and telephone. They hope to attend the Independent Telephone meeting in Chicago and also to participate in the Institute meeting at Niagara. If possible they will go as far west as San Francisco.

MR. WILLIAM BURLINGHAM has accepted an appointment as chief engine designer with the B. F. Sturtevant Company, of Hyde Park, Mass., resigning a position in the United States Inspection office with the Wm. R. Trigg Company, of Richmond, Va. Mr. Burlingham has previously been associated with the Bath Iron Works, the General Electric Company, the Southwark Machine & Foundry Company, and the Newport News Ship-Building & Dry Dock Company. He has also served on Mr. T. A. Edison's staff at the East Orange laboratory and is a graduate of the Worcester Polytechnic Institute.

COL. R. C. CLOWRY.—A rumor was current in Wall Street last week that Colonel Robert C. Clowry, the president of the Western Union Telegraph Company, will retire in favor of Charles A. Tinker, of Brooklyn, who, until several months ago, was general superintendent of the company. The report could not be confirmed, the officials of the company refusing to discuss it. Colonel Clowry has been president of the Western Union for one year, having succeeded General Eckert. Before he became the head of the corporation he was vice-president and general manager. He has moved from Chicago and has lately bought a fine residence in New York City.

PROF. A. G. COMPTON.—Five hundred members of the Associated Alumni of the College of the City of New York gave a dinner this week to the acting president of the college, Alfred G. Compton, at the Arion Society's rooms. The dinner commemorated his fifty years of service in the college faculty, which he entered in 1853, directly from the first class graduated there. He became professor of applied mathematics in 1869, and last December was selected to act as president until the inauguration on Oct. 1 of this year of John H. Finley as head of the institution. Prof. Compton is well known in the electrical field, and has been an officer of the American Institute of Electrical Engineers.

MR. S. M. HAMILL, of the General Electric, Brush and other companies, has lost his mother, Mrs. Matilda M. Hamill, the widow of the Rev. Dr. Samuel M. Hamill, for fifty years the head of the famous school at Lawrenceville, N. J. She was in her eighty-sixth year. She was a direct descendant of Jonathan Dickinson, the first president of Princeton, and for one hundred and fifty years her family have been closely connected with the educational interests of the country. Another son is Mr. Hugh H. Hamill, the president of the Trenton Trust & Safe Deposit Company, and a director of the new Public Service Corporation operating extensive railway and lighting systems in New Jersey.

MESSRS. ISAAC BAUM, of Uniontown, Pa., and Florence James Schwab, of New Orleans, La., seniors in the department of electrical engineering in Cornell University, have for a year been investigating the subject of refining copper at a reduced cost, and have, as reported, written a thesis on this subject and submitted it to Prof. W. D. Bancroft, of the department of chemistry. Mr. Baum says: "We believe that we have discovered a chemical process whereby copper may be refined at a reduced cost. However, we refuse to give anything out regarding the process until we have again gone over the whole situation with Prof. Bancroft, and hereafter anything which comes out will be through him." Prof. Robert H. Thurston, director of the department of mechanical engineering, speaks well of Mr. Baum and Mr. Schwab as students.

MR. CYRUS FIELD JUDSON, who is a grandson of the late Cyrus W. Field, and who resigned as a director of the International Power Company in May, 1902, after a manipulation he undertook of the company's stock had collapsed in a sensational fashion, has been examined in supplementary proceedings under a judgment for $3,195 on a note held by stock brokers. Justice Truax has appointed John T. Little receiver in the proceeding. Mr. Judson began in the real estate business in 1889, but he has been principally active as a promoter. A few years ago he was president of the General Carriage (Automobile) Company, which became financially embarrassed. He is a director of the International Power Company and of the Ardsley Casino Company.

GENERAL A. W. GREELY, head of the United States Signal Service Corps, who went to England in connection with the international telegraph conference has returned. Speaking of the international vocabulary proposition put forward he said that it would mean the complete revising of all American cable codes, and every other cable code as well, which would mean a waste of a great deal of time, as well as of money. One thing which the General thought was of great benefit was a rule that in future groups of five letters may be counted as one word; for instance, formerly "U. S. A." would count as three words, now it will count as one. Gen. Greely announced that on Aug. 4 a conference of men interested in wireless telegraphy would be held in Berlin. The invitation to the conference was supposed to be general, the chief of the signal bureau said.

MR. H. H. VREELAND.—In response to an invitation received from the Royal Commission on London Traffic, H. H. Vreeland, president of the Interurban Street Railway Company, will early in July proceed to England for the purpose of appearing before the commission as an expert in street railway matters. Mr. Vreeland will advise the commission on means to overcome traffic congestion. He will also visit the Continent, combining business and pleasure in an investigation of the Old World railway systems. During his absence Frank Gannon, vice-president, will assume charge of the construction work in New York. It was for that purpose that Mr. Gannon recently became attached to Mr. Vreeland's staff. Mr. Vreeland has not been off the property thirty days at a time since he took charge eleven years ago. The invitation from the Royal Commission was received several weeks ago. The Commission was suggested to King Edward by the difficulty encountered in improving transportation.

MR. PERCEVAL E. FANSLER, chief clerk of the department of electrical exhibits, etc., of the Louisiana Purchase Exposition, received the degree of electrical engineer from the Purdue University on June 11, after passing an oral examination over long-distance telephone. Mr. Fansler was graduated from a school of electrical engineering in 1901, and spent a year in a post graduate course of Purdue, making a special study of the electrical traction problem. A comprehensive test of the system of the Union Traction Company of Indiana was taken by Mr. Fansler as a thesis, and upon its acceptance the faculty ordered Mr. Fansler to report for examination. The examination was set for Monday, June 8, but the St. Louis flood made it impossible for Mr. Fansler to get to Lafayette, Ind., and he obtained permission to take the examination by telephone. Accordingly, the four examiners—Prof. W. E. Goldsborough, C. P. Mathews, W. D. Pence, and J. W. Esterline—were connected with the long-distance telephone at the same time, and for hours Mr. Fansler was plied with questions. On the recommendation of the examiners a degree was awarded to Mr. Fansler by the president and faculty.

EDUCATIONAL.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Contracts have been signed in Boston for the erection of a new building for the Massachusetts Institute of Technology. The structure has been planned to accommodate the departments of naval architecture, mineralogy and chemical research, and will be known as "Engineering Building C." It will be erected at the corner of Stanhope Street and Trinity Place, opposite the Trinity Place station of the Boston and Albany Railroad. It is intended that the building shall be ready for occupancy in the fall, and it will be an indirect aid to the resources of the United States Naval Academy at Annapolis, because of the Government practice in sending cadets to Boston for instruction in naval architecture at the Massachusetts Institute of Technology. Frank B. Gilbreth will erect the building.

Trade Notes.

MR. WM. ROCHE, 42 Vesey St., New York, manufacturer of the New Standard dry battery, reports his business as better than ever before in its history. He has just closed contracts for over a million and a half dry cells.

MR. C. J. HARRINGTON, 15 Cortlandt St., New York, manufacturer of the well-known Empire overhead railway material is sending out to the trade a handsome little souvenir in the shape of a manicure nail file inclosed in a neat leather case.

COMMERCIAL AUTO CONTEST.—In the recent commercial vehicle test of the Automobile Club of America, the International Motor Car Company, of Toledo, has been awarded a bronze medal for its Waverly electric delivery wagon, third class, to carry 3,500 pounds.

THE INTERNATIONAL TELEPHONE MFG. CO., Chicago, is reporting a heavy demand for its portable desk telephone with the "figure 8" switch restoring spring. It is said that this instrument is provided with one of the most scientifically designed, strong, durable and positive sliding contact switches ever invented.

THE NARRAGANSETT MACHINE COMPANY, Providence, R. I., has just issued a catalogue of hand screws, clamps, mallets and handles. All manufacturing concerns use most of these articles, and the Narragansett Company make a complete line of goods of this character. Price lists and illustrations of the goods are also given.

CORRESPONDENCE INSTRUCTION.—The U. S. Government has adopted the instruction papers of the American School for Correspondence in steam and electrical engineering for text books in the School of Submarine Defense, at Fort Totten, N. Y. The instruction paper on storage batteries is used as a text book by the seniors at Columbia University, New York.

REMOVAL.—The Commercial Electric Company, Indianapolis, Ind., has removed its main offices and factory to new and commodious quarters at West Twenty-first Street and Northwestern Ave., that city. The company now possesses an excellent manufacturing plant and equipment, and the best of facilities for producing its line of direct current motors and dynamos.

THE A. & W. ELECTRIC SIGN COMPANY, of Cleveland, Ohio, has opened a new factory at the corner of Champlain and Michigan Streets that city, and the offices have been removed from the Garfield Building to the new location. The company is rapidly acquiring an enviable reputation for the manufacture of electric signs and is shipping some very large outfits to all portions of the country.

THE ELLIOTT ELECTRIC BLUE PRINT COMPANY, Pittsburg, Pa., has just issued a very complete catalogue of drawing materials and surveying instruments. The catalogue is profusely illustrated, and includes views of the blue printing apparatus which is a specialty of this company. It enables the production of blue prints by electric light, thus rendering this work independent of natural light, which is not always satisfactory for printing purposes.

THE VICTOR ELECTRICAL COMPANY, of Cleveland, Ohio, has established itself in a new factory at the corner of Mason Street and the Pennsylvania Railway. The company does electrical repair work of all kinds and deals in second-hand electrical material of every description. Under the title of the "Magnet" the company publishes a monthly circular of bargains and sample copies will be sent to anyone in need of second-hand electrical equipment.

THE SHEPHERD ENGINEERING COMPANY, manufacturer of the well-known line of Shepherd steam engines, will after July 1, have its general offices and works at Franklin, Pa., where it has secured for the manufacture of its product the large and modern plant constructed a few years ago by the Grant Tool Company. This plant will enable the Shepherd Engineering Company to take care of its greatly increased business, and to make prompt deliveries on future work.

THE SOURCE OF ELECTRIC LIGHT.—Under this title the Crocker-Wheeler Company, Ampere, N. J., has issued a very handsome booklet of sixteen pages. Each page is headed by an illustration of a Crocker-Wheeler generator of a particular type, many of the views showing actual installations. The text, which is in large, clear type, sets forth briefly the requirements for the steady and reliable production of current and the elements contributing to this result. The various types of machines manufactured by the company are referred to in connection with the different illustrations, some of the principal features of construction in each case being pointed out.

THE CONSOLIDATED "AXLE LIGHT" equipments of electric car lighting are steadily coming into general use on the finest cars constituting the best and fastest trains of leading railway lines, including the Pullman cars on all these trains. All private Pullman cars and nearly all the business cars of railway officials, as well as private cars of individuals, are equipped with the Consolidated "Axle Light" system. These equipments are also beginning to be used quite extensively on the railway systems of Great Britain and Europe, and are a great boon to the traveler, wherever encountered.

LUNDELL FANS.—The Sprague Electric Company, New York, has issued a catalogue (No. 306) of its 1903 Lundell fans. Desk fans and bracket fans of many styles and ceiling and exhaust fans are well illustrated and briefly described. At the back part of the pamphlet are given a price list of parts, telegraph code, code word index, etc. The frontispiece consists of a view of "The Real North Pole." On the spot which has been the goal of all arctic expeditions stands a Lundell desk fan in the midst of frigid surroundings, and resplendent with the rays of the aurora borealis.

GORDON CELLS.—The Gordon Battery Company, New York, will have an exhibit of its cells at the independent telephone convention in Chicago next week, and all those in attendance at the convention are cordially invited to call and examine it. The company states its cells are particularly well adapted for central energy, switchboard and other telephone uses, as certified to by the well satisfied telephone companies and manufacturers who are using them. The company has a Chicago office at 358 Dearborn Street in charge of Mr. E. M. Deems and is represented by the Wrenn Commercial Company, Ltd., 515 Mission St., San Francisco, as sole agent for the Pacific Coast. Any information desired will be cheerfully furnished by the agents and home office.

THE CALCULAGRAPH.—The Calculagraph Company, 9 Maiden Lane, New York, has just issued a handsome pamphlet describing and illustrating the varied uses of the calculagraph. This instrument, as is now well-known, prints upon a card the time elapsed from the beginning to the end of any event. It is especially valuable for calculating the time and labor expended in producing any article, machine, etc., and therefore finds a large field in manufacturing establishments where a record of the exact cost of production is desirable. It is also very extensively used by telephone companies for timing conversations held over toll lines, where the charge for service is based on the length of time a circuit is used. The pamphlet is very attractively illustrated and its contents cannot fail to interest the business man.

L. B. ALLEN CO., INC., Chicago, the originator, patentee and sole maker of Allen electrical compounds—which include the well-known Allen soldering stick, Allen soldering paste, Allen's soldering salts and Allen commutator lubricant—writes that business in all branches is on the increase. In the Allen soldering stick business alone, for the past four months the actual shipments of this one handy article were almost as great as for the same period of the two previous years put together. L. B. Allen Co. is constantly carrying on a series of exhaustive experiments for the improvement of its products, in an earnest endeavor to "make good" its motto: "Prae ad Supremum" (Forward to the Highest). Indications are that its present plant, newly erected less than a year and a half ago, will have to be doubled in size within a short time.

AIR COMPRESSORS.—The American Air Compressor Works, Havemeyer Building, New York, have just brought out a 54-page catalogue in which are illustrated and described the many types of the American air compressors, air receivers, vacuum pumps, carbonic acid gas and high pressure compressors, and the American air lift pumping system. The catalogue also contains information relative to pneumatic tools and a table showing the flow of air through various size orifices. The American Air Compressor Works have their own foundry, both brass and iron, pattern and blacksmith shops, and their machine shop is equipped with the very latest and most improved tools. Their claim is simplicity, durability, efficiency and economy all embodied in a machine designed for maximum strength with minimum weight. The catalogue is the standard 6x9 and is used for gratuitous distribution upon application.

ALCOHOL AS FUEL FOR INTERNAL COMBUSTION ENGINES.—Tests made by Mr. C. W. Weiss at the Mietz & Weiss engine works, 128-138 Mott Street, New York City, with Cuban and Brazilian cheap alcohol as fuel in their standard kerosene engine, have been reported as entirely satisfactory. The object was to substitute alcohol for kerosene; the former being considerably cheaper and more readily obtainable in Cuba and South America, where many of these engines are being exported. It was found that a mixture of four pints of alcohol and two pints of water developed 4-hp for one hour. The mixture of alcohol varies, however, with the quality of the former, being limited by the practical degree of compression prior to combustion. The specific gravity of the mixture is .9; the pure alcohol was .794. The development of the alcohol engine is of the greatest importance to the power question of Cuba, Brazil and the Philippine Islands.

TELEPHONE EQUIPMENT.—The E. G. Bernard Company, Troy, N. Y., has recently moved into its new and modern factory and announces in a catalogue of telephones and telephone equipment—just issued—that it aims to produce the finest telephone apparatus in the world, and that its new factory is one of the largest and best equipped of any independent telephone manufacturing concern. The company manufactures every detail part from the raw material directly under its own supervision, thus enabling it to produce instruments of the highest quality. The catalogue, which has 68 pages, is well illustrated with the company's standard types of apparatus and details, all of which illustrations are accompanied by a brief description of the devices concerned. The contents show telephones of all kinds, including battery magnets, wall sets of a large variety, central energy sets, portable sets, instruments in weather-proof boxes for out-of-door uses, intercommunicating sets, desk sets, and a complete line of switchboards.

THE NERNST LAMP COMPANY, of Pittsburg, Pa., has established a maintenance bureau for the purpose of supplying users of Nernst lamps with new burners or holders, so it will not be necessary for the customer to visit or call upon the electric light stations when one of his lamps gives out. The maintenance bureau makes a contract to supply to its customers a certain number of extra holders which are kept in a box especially made for this purpose. He simply takes one of these extra holders and replaces the old one with it, returning the old holder to the box, which is called for by a messenger attached to the bureau. This messenger takes the burned out holders to the bureau, and they are refilled and returned to the customr. The taking out and putting in of these holders is as easily accomplished as the changing of incandescent lamps. By this method, the users of Nernst lamps are not put to the inconvenience of notifying the electric light company when the lamp gives out; thus avoiding the necessary delay in having their lamps renewed.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 9, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

730,236. REPEATING BREAK FOR ELECTRIC CIRCUITS; Leo Daft, Ealing and Alfred Williams, Wimbledon, England. App. filed Nov. 3, 1902. (See Current News and Notes.)

730,246. SPACE TELEGRAPHY; Lee De Forest, New Haven, Conn. App. filed March 8, 1902. (See Current News and Notes.)

730,247. WIRELESS TELEGRAPHY; Lee De Forest, New Haven, Conn. App. filed Nov. 4, 1902. (See Current News and Notes.)

730,251. ELECTRIC MOTOR CAR AND SYSTEM OF MOUNTING AND WIRING ELECTRICAL APPARATUS THEREON; George Gibbs, New York, N. Y. App. filed Dec. 1, 1902. The wiring of the car is inclosed in a suitable insulating tubes which are supported at some distance below the floor of the car and out of contact with inflammable parts.

730,252. ELECTRIC COOKER; Edward E. Gold, New York, N. Y. App. filed July 16, 1896. (See Current News and Notes.)

730,262. ELECTRIC METER; Eugen Hartmann, Frankfort-on-the-Main, Germany. App. filed Feb. 24, 1902. Details.

730,293. RECEPTACLE FOR INCANDESCENT LAMPS; Henry T. Paiste, Philadelphia, Pa. App. filed Jan. 23, 1902.

730,302. CLOCK; William S. Scales, Boston, Mass. App. filed Feb. 1, 1902. A winding mechanism common to both the time and strike mechanism and means for automatically winding the same.

730,312. RAILWAY; Edward Stiles, New York, N. Y. App. filed Sept. 29, 1902. A pivoted lip normally closes the slot in a conduit formed beside the rail; the flange of the car wheel moves the lip one side and at the same time makes contact with a conductor terminal carried by the lip.

730,334. CONTROLLER APPARATUS; Patrick S. Barrett and John P. Durkin, Scranton, Pa. App. filed Aug. 21, 1902. Details of construction for controlling the movement of the controller handle.

730,341. SYSTEM OF MOTOR CONTROL; Frank E. Case, Schenectady, N. Y. App. filed Feb. 12, 1900. The master controller controls the circuit of a storage battery system in order to charge the battery at times, and utilize the battery current at other times for operating the motor controllers.

730,342. SYSTEM OF MOTOR CONTROL; Frank E. Case, Schenectady, N. Y. App. filed April 24, 1902. This invention permits the motor circuit to be opened at the controller contacts on any car upon which an excessive flow of current flow occurs, without affecting the circuit connections on other cars of the train; it at the same time permits the motor circuit to be again closed as soon as the master controller has been moved to a position where a protecting resistance will be included in the motor circuit.

730,343. ALTERNATING-CURRENT MOTOR; Alexander J. Churchward, Brooklyn, N. Y. App. filed March 29, 1897. (See Current News and Notes.)

730,346. ELECTRICALLY CONTROLLED LOCK; James Corbett, Toronto, Canada. App. filed Nov. 27, 1901. Details.

730,369. ELECTRIC ARC LAMP; Charles E. Harthan, Lynn, Mass. App. filed Feb. 9, 1901. A compensating winding is used on the shunt coils and the rocker which connects the armatures of the series and shunt magnets is made in two separate, overlapping, independently pivoted parts, connected so as to move simultaneously.

730,371. REVERSE CURRENT RELAY; Edward M. Hewlett, Schenectady, N. Y. App. filed Feb. 3, 1902. The movable element of the device is mounted in such a position with relation to the field magnet, that it is in a condition of maximum torque, but movement in one direction is resisted by a fixed stop against which it is held until a reversal of current occurs, upon which a quick movement is made by reason of the magnetic relation described.

730,376. CONTROLLING ELECTRIC MOTORS; James W. Kellogg, Schenectady, N. Y. App. filed Nov. 28, 1902. The circuit is automatically broken outside of the rheostat if the starting switch is left in any other than the running position.

730,379. CIRCUIT CONTROLLER FOR SURGICO DENTAL ENGINES; Joseph S. Letord, William W. Alexander and Henri Letord, Kansas City, Mo. App. filed July 7, 1902. Details of construction.

730,397. POWER FACTOR INDICATOR; William H. Pratt, Lynn, Mass. App. filed March 26, 1903. The instrument is constructed so that the reading will within limits be independent of frequency.

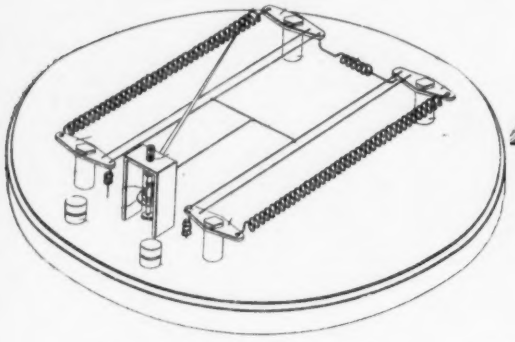
730,401. MECHANICAL VENTILATION OF ELECTRIC MACHINES; Auguste Camille Edmond Rateau, Paris, France. App. filed June 28, 1902. (See Current News and Notes.)

730,403. BOND FOR RAILWAY RAILS; John Risberger, Northeast, Pa. App. filed Oct. 17, 1902. The studs to which the ends of the flexible bond are secured, have flaring arms which prevent short bends of the bond.

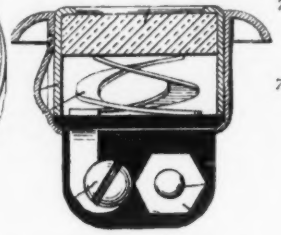
730,405. HOT WIRE INSTRUMENT; Maurice C. Rypinski, Schenectady, N. Y. App. filed March 31, 1902. A hot wire electrical measuring instrument comprising a stretched wire adapted to carry current, an elastic abutment to maintain it under tension, an indicator to determine its amount of sag, and a compensating wire connected to the abutment and disconnected from the circuit.

730,420. WATCHMAN'S CLOCK; Albert E. Waggoner, Grand Rapids, Mich. App. filed Aug. 13, 1902. Details.

730,422. ELECTRIC PROTECTIVE SYSTEM; Joseph Weatherby, Jr., Philadelphia, Pa. App. filed Aug. 11, 1902. Details.



730,405.—Hot Wire Instrument.



730,567.—Electric Push Button.

730,523. MEANS FOR PREVENTING ARCING IN DIRECT CURRENT MOTORS OR GENERATORS; Herbert H. Dow, Midland, Mich. App. filed Jan. 2, 1903. Two brushes bearing upon contiguous segments of the commutator are short-circuited through a polarizing battery.

730,545. ELECTRIC FOOT ARCH SUPPORTER; Frank B. Lee, Buffalo, N. Y. App. filed Dec. 30, 1902. Details.

730,567. ELECTRIC PUSH BUTTON; August W. Plassmann, New York, N. Y. App. filed Jan. 29, 1902. A flush push button in which the contacts are in the form of two spiral springs, the turns of which alternate with each other so that by compressing the two springs, their turns will be brought into elongated contact; the invention also includes details of construction affording a simple and cheap form of this class of button.

730,573. CEILING SWITCH; Howard R. Sargent, Schenectady, N. Y. App. filed Sept. 20, 1901. By pulling on the cord the switch blade is closed and by giving a sharp jerk the blade is released and opened.

730,576. ELECTRIC ALARM SYSTEM; Solomon Schwarzchild, Rochester, N. Y. App. filed July 25, 1902. Details.

730,582. ARMATURE FOR DYNAMO-ELECTRIC MACHINES; Charles P. Steinmetz, Schenectady, N. Y. App. filed Aug. 16, 1899. (See Current News and Notes.)

730,594 INCLOSED FUSE FOR ELECTRIC CIRCUITS; Willard S. Atkinson, New Brunswick, N. J. App. filed Feb. 10, 1902. The fuse is contained in a transparent case and surrounded by material adapted to disrupt the arc and to present a different appearance after the arc is blown to serve as an indicator of the fact.

730,595. GROUND DETECTOR; Charles C. Badeau, Schenectady, N. Y. App. filed July 26, 1901. A ground detector having a spark gap of greater dielectric resistance between the line terminals than to ground and means for cutting on and off the ground.

730,601. LIGHTNING-ARRESTER; Louis Bell, Newton Center, Mass. App. filed April 5, 1900. (See Current News and Notes.)

730,613. METER; Frank P. Cox, Lynn, Mass. App. filed Feb. 24, 1903. (See Current News and Notes.)

730,621. MAGNETIC CLUTCH; Arthur C. Eastwood, Cleveland, Ohio. App. filed April 2, 1903. Brass shoes are interposed between the faces of the clutch to prevent sticking by residual magnetism.

730,629. CONSTANT CURRENT ROTARY CONVERTER; Richard Fleming, Swampscott, Mass. App. filed Nov. 12, 1900. The armature of a dynamo electric machine is supplied with a constant potential alternating current and a consumption circuit is supplied with a constant direct current derived from said armature.

730,644. RHEOSTAT; Charles E. Harthan, Lynn, Mass. App. filed April 21, 1902. A rheostat comprising spider heads and a central standard around which blocks of insulating material are grouped, the resistance wire being wound upon the blocks.

730,652. PHASE-INDICATOR; Otto Holz, Schenectady, N. Y. App. filed Oct. 27, 1902. (See Current News and Notes.)

730,667. CONTROLLER FOR ELECTRIC MOTORS; John B. Linn, Schenectady, N. Y. App. filed Dec. 28, 1900. An attachment fitting on top of a standard controller and comprising connected mechanism to engage with the shaft of the contact cylinder and reversing switch to thereby enable both to be actuated by one handle.

730,673. METHOD OF GENERATING ALTERNATING CURRENTS; Alexander D. Lunt, Schenectady, N. Y. App. filed Aug. 25, 1899. A rotary magnetic field is derived from a single phase magneto motive force and a conductor is rotated in said magnetic field at a definite speed.

730,696. ELECTRICAL ROSETTE CUT OUT; Clarence D. Platt, Bridgeport, Conn. App. filed March 4, 1903. Details.

730,698. ELECTRICAL MEASURING INSTRUMENT; William H. Pratt, Lynn, Mass. App. filed Sept. 10, 1902. An electrical measuring instrument having a magnetic return-piece for its movable element, provided with a plurality of pairs of poles forming an astatic system, all polarized by a single core.

730,704. CIRCUIT BREAKER FOR ELECTRIC CIRCUITS; Robert H. Read, Schenectady, N. Y. App. filed Feb. 24, 1902. The preliminary motion of the handle draws the arc and creates a pressure of fluid which thereafter serves to extinguish the arc.

730,733. SIGNAL DEVICE FOR DRIP PANS; Victor Ayotte, Jr., Providence, R. I. App. filed March 4, 1903. A circuit closer operated by a float.

730,746. ART OF MAKING STEEL DIRECT FROM IRON ORE; Michael R. Conley, Brooklyn, N. Y. App. filed Jan. 27, 1902. (See page 1058.)

730,753. SIGNALING BY ELECTROMAGNETIC WAVES; Reginald A. Fessenden, Pittsburg, Pa. App. filed April 9, 1903. (See Current News and Notes.)

730,768. INCANDESCENT LAMP; Christian Hoelscher, Warren, Ohio. App. filed April 2, 1902. Details.

730,847.—Flexible Electrical Conductor.

730,785. APPARATUS FOR RADIOTHERAPEUTIC TREATMENT; Eugen K. Muller, Zurich, Switzerland. App. filed Jan. 10, 1902. The patient is subjected to the action of an undulating magnetic field, the radiations of which are said to possess curative properties.

730,805. INSULATOR; William G. Stroh, Hume, Ill. App. filed March 7, 1903. A curved and undercut slot in the top of a porcelain knob.

730,810. SWITCH ESPECIALLY ADAPTED FOR THIRD RAILS FOR ELECTRIC RAILWAYS; William A. P. Willard, Jr., New York, N. Y. App. filed Nov. 11, 1901. Details.

730,819. WIRELESS SIGNALING; Lee De Forest, New Haven, Conn. App. filed March 8, 1902. (See Current News and Notes.)

730,828. SYSTEM OF PHASE TRANSFORMATION; Frank H. Jeannin, Schenectady, N. Y. App. filed Oct. 20, 1902. A combination of three-phase mains, a winding having two points intermediate its ends connected to two of said mains and means for impressing quarter-phased electromotive forces between the third main and the end sof the winding .

730,833. GALVANIC BATTERY; John R. Lord, Tottenville, N. Y. App. filed Feb. 20, 1903. The exhausted electrolyte is heated for a time sufficient to evaporate the liquid and convert the salts contained therein to an active form.

730,840. MAGNETIC SUSPENSION DEVICE; William H. Pratt, Lynn, Mass. App. filed Oct. 10, 1902. (See Current News and Notes.)

730,844. ARC LAMP HANGER; Charles H. Schultz, St. Joseph, Mo. App. filed June 9, 1902. Details.

730,845. COMPOSITE TUBE; Robert W. Taylor, West Hoboken, N. J. App. filed Aug. 1, 1902. A plurality of spiral wound paper tapes, one inclosed by the other with adjacent convolutions overlapping and mica interposed between the layers.

730,847. FLEXIBLE ELECTRICAL CONDUCTOR; Lincoln Van Gilder and Edward M. Post, Philadelphia, Pa. App. filed Nov. 8, 1902. An insulating tube containing a stranded conductor surrounded by a mercury conductor.

730,854. ELECTRIC SIGN; Harry B. Wren, Washington, D. C. App. filed June 7, 1902. (See Current News and Notes.)

12,117. ELECTRODEPOSITED LEAD; Anson Gardner Betts, Lansingburg, N. Y. App. filed Nov. 11, 1902. (See Current News and Notes.)